EXHIBIT E

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 78905

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

CHIARO TECHNOLOGY LIMITED

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	[signature]	Date (Optional)	18 JULY 2018
Name	ANDREA ZITNA		
Title	CHIEF REVENUE OFFICER		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

PATENT **Docket No. 373499.00050**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

INVENTORS:	**Jonathan O'TOOLE et al.**	Confirmation No.
APPLICATION NO.	**TBD**	
FILED:	**Herewith**	Examiner:
CASE NO.	**373499.00050**	Group Art Unit:
TITLE:	**BREAST PUMP SYSTEM**	

FILED ELECTRONICALLY ON March 16, 2021

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §§1.97 AND 1.98

Sir:

Submitted herewith for the above-identified application is an Information Disclosure Statement under 37 CFR §§1.97 and 1.98. Pursuant to 37 CFR §1.98(d)(1), Applicant has not provided copies of the foreign patent and non-patent literature cited in the accompanying Information Disclosure Statement ("IDS"), since copies of these publications were submitted in IDS's filed on June 15, 2018; December 7, 2018; or November 3, 2020, in grandparent Application No. 16/009,547, of which the parent of the present application is a continuation.

The Examiner is requested to initial a copy of the enclosed Form PTO-1449 and return a copy to applicant.

Respectfully submitted

March 16, 2021
Date

/Mark D. Simpson/
Mark D. Simpson, Esquire
Registration No. 32,942

SAUL EWING ARNSTEIN & LEHR LLP
Centre Square West
1500 Market Street, 38th Floor
Philadelphia, PA 19102-2189
Telephone: 215 972 7880
Email: Mark.Simpson@saul.com

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2849881	A	1958-09-02	ANDERSON	
	2	4390024	A	1983-06-28	WILLIAMS	
	3	4535627	A	1985-08-20	PROST, et al.	
	4	5474683	A	1995-12-12	BRYANT, et al.	
	5	5941847	A	1999-08-24	HUBER, et al.	
	6	5973770	A	1999-10-26	CARTER, et al.	
	7	6045529	A	2000-04-04	NUEESCH	
	8	6090065	A	2000-07-18	GILES	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	9	6227936	B1	2001-05-08	MENDOZA	
	10	6328709	B1	2001-12-11	HUNG, et al.	
	11	6358226	B1	2002-03-19	RYAN	
	12	6383163	B1	2002-05-07	KELLY, et al.	
	13	6440100	B1	2002-08-27	PRENTISS	
	14	6461324	B1	2002-10-08	SCHLENSOG	
	15	6547756	B1	2003-04-15	GRETER, et al.	
	16	6579258	B1	2003-06-17	ATKIN, et al.	
	17	6663587	B2	2003-12-16	SILVER, et al.	
	18	6749582	B2	2004-06-15	BRITTO, et al.	
	19	7048519	B2	2006-05-23	FONG, et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	20	7201735	B2	2007-04-10	ATKIN, et al.	
	21	D548831	S	2007-08-14	CHARLEZ	
	22	7312554	B2	2007-12-25	VOGELEY	
	23	7314400	B2	2008-01-01	FILDAN, et al.	
	24	7662018	B1	2010-02-16	THOMPSON	
	25	7776008	B2	2010-08-17	RENZ, et al.	
	26	8057425	B1	2011-11-15	MYERS, et al.	
	27	8118772	B2	2012-02-21	DAO, et al.	
	28	8187227	B2	2012-05-29	LUZBETAK, et al.	
	29	8262606	B2	2012-09-11	GRETER, et al.	
	30	8282596	B2	2012-10-09	GRETER, et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	31	8376986	B2	2013-02-19	VAN, et al.	
	32	8702646	B2	2014-04-22	GARBEZ, et al.	
	33	8801495	B1	2014-08-12	GUINDON	
	34	8876760	B2	2014-11-04	BOSMAN, et al.	
	35	8926556	B2	2015-01-06	VAN EIJKELENBORG, et al.	
	36	9033913	B2	2015-05-19	KHALIL, et al.	
	37	9173587	B2	2015-11-03	VAN SCHIJNDEL, et al.	
	38	9345274	B1	2016-05-24	PRILL	
	39	9539377	B2	2017-01-10	MAKOWER, et al.	
	40	10039871	B2	2018-08-07	POLLEN, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020193731	A1	2002-12-19	MYERS, et al.	
	2	20040056641	A1	2004-03-25	MYERS, et al.	
	3	20040074281	A1	2004-04-22	LOBDELL, et al.	
	4	20040267215	A1	2004-12-30	CHARLEZ, et al.	
	5	20050219302	A1	2005-10-06	VOGELEY, et al.	
	6	20060122575	A1	2006-06-08	WAKABAYASHI	
	7	20070051172	A1	2007-03-08	PERINET, et al.	
	8	20070051727	A1	2007-03-08	HOLLEY	
	9	20080177224	A1	2008-07-24	KELLY, et al.	
	10	20080262420	A1	2008-10-23	DAO, et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	11	20080275386	A1	2008-11-06	MYERS	
	12	20110004154	A1	2011-01-06	VAN, et al.	
	13	20110196291	A1	2011-08-11	VISCHER, et al.	
	14	20110274566	A1	2011-11-10	AMIROUCHE, et al.	
	15	20120277636	A1	2012-11-01	BLONDHEIM, et al.	
	16	20130023821	A1	2013-01-24	KHALIL, et al.	
	17	20140031744	A1	2014-01-30	CHEN	
	18	20140052056	A1	2014-02-20	GARBEZ, et al.	
	19	20140275857	A1	2014-09-18	TOTH, et al.	
	20	20140323962	A1	2014-10-30	KOOIJKER, et al.	
	21	20140378895	A1	2014-12-25	BARACK	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	22	20150217036	A1	2015-08-06	POLLEN, et al.	
	23	20150217037	A1	2015-08-06	POLLEN, et al.	
	24	20150283311	A1	2015-10-08	ALVAREZ, et al.	
	25	20160000980	A1	2016-01-07	ALVAREZ, et al.	
	26	20160058928	A1	2016-03-03	NOWROOZI, et al.	
	27	20160058929	A1	2016-03-03	MEDVEDEV, et al.	
	28	20160082165	A1	2016-03-24	ALVAREZ, et al.	
	29	20160082166	A1	2016-03-24	GUTHRIE, et al.	
	30	20160151551	A1	2016-06-02	FELBER	
	31	20160158424	A1	2016-06-09	CHEN, et al.	
	32	20160166745	A1	2016-06-16	AALDERS	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	33	20160206794	A1	2016-07-21	MAKOWER, et al.	
	34	20160220743	A1	2016-08-04	GUTHRIE, et al.	
	35	20160220745	A1	2016-08-04	GUTHRIE, et al.	
	36	20160256617	A1	2016-09-08	HANSEN	
	37	20160271305	A1	2016-09-22	KURIHARA, et al.	
	38	20160287767	A1	2016-10-06	SIMMONS, et al.	
	39	20160296681	A1	2016-10-13	GASKIN, et al.	
	40	20160310650	A1	2016-10-27	MAKOWER, et al.	
	41	20170021068	A1	2017-01-26	GASKIN, et al.	
	42	20170035951	A1	2017-02-09	TANAKA	
	43	20170043065	A1	2017-02-16	TAKEUCHI	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	44	20170072117	A1	2017-03-16	KURIHARA, et al.	
	45	20170072118	A1	2017-03-16	MAKOWER, et al.	
	46	20170095599	A1	2017-04-06	KONDO, et al.	
	47	20170143879	A1	2017-05-25	OKAGUCHI	
	48	20170220753	A1	2017-08-03	GUTHRIE, et al.	
	49	20180021490	A1	2018-01-25	CHANG, et al.	
	50	20180110906	A1	2018-04-26	BARACK	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	3311982	DE	C2	1983-10-13	BATTELLE MEMORIAL INSTITUTE		
	2	9503280	EP	A2	1992-02-08	PIERBURG GMBH		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	3	9420158	WO	A1	1994-09-15	DEKA PRODUCTS LIMITED PARTNERSHIP		
	4	19750620	DE	A1	1999-06-02	SIEMENS AG, 80333 MUENCHEN, DE		
	5	1586340	EP	A2	2005-10-19	SEA PROFIT (HONG KONG) LIMITED		
	6	2005114116	WO	A1	2005-12-01	LANE, JOHN, DENNIS; ESPARZA, JOSEPH, LUIS; NICHOLS		
	7	2005114113	WO	A3	2006-03-02	ACCU-GAUGE LIMITED		
	8	1430918	EP	B1	2008-05-14	MEDELA HOLDING AG		
	9	2344380	RU	C1	2009-01-20	GOSUDARSTVENNOE OBRAZOVATEL'NOE UCHREZHDENIE VYSSH		
	10	2009134271	WO	A1	2009-11-05	UTC POWER CORPORATION		
	11	2473022	GB	B	2011-12-14			
	12	2441367	RU	C2	2012-02-10	OBSHCHESTVO S OGRANICHENNOJ OTVETSTVENNOST'JU 'NAU		
	13	2436277	EP	A1	2012-04-04	DREW, LORNA		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	14	2210628	EP	B1	2013-02-13	MEDELA HOLDING AG		
	15	2499248	GB	B	2014-04-02	ELIZABETH MORANA		
	16	1404393	EP	B1	2014-12-24	MEDELA HOLDING AG		
	17	2015081459	WO	A1	2015-06-11	CHEN, JUNBO		
	18	2015116749	WO	A1	2015-08-06	CORNING INCORPORATED		
	19	2015120321	WO	A1	2015-08-13	NAIA HEALTH, INC.		
	20	2015150225	WO	A1	2015-10-08	KONINKLIJKE PHILIPS N.V.		
	21	2015174330	WO	A1	2015-11-19	MURATA MANUFACTURING CO., LTD.		
	22	2016002606	WO	A1	2016-01-07	MURATA MANUFACTURING CO., LTD.		
	23	2016006494	WO	A1	2016-01-14	MURATA MANUFACTURING CO., LTD.		
	24	2016006496	WO	A1	2016-01-14	MURATA MANUFACTURING CO., LTD.		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	25	2016007560	WO	A1	2016-01-14	NAYA HEALTH, INC.		
	26	2016010524	JP	A	2016-01-21	MURATA MFG CO LTD		
	27	2016014469	WO	A1	2016-01-28	EXPLORAMED NC7, LLC		
	28	2016014488	WO	A1	2016-01-28	EXPLORAMED NC7, LLC		
	29	105288759	CN	A	2016-02-03	SHANGHAI NORMAL UNIVERSITY		
	30	2016024558	WO	A1	2016-02-18	MURATA MANUFACTURING CO., LTD.		
	31	2016039083	WO	A1	2016-03-17	MURATA MANUFACTURING CO., LTD.		
	32	2016104673	WO	A1	2016-06-30	MURATA MANUFACTURING CO., LTD.		
	33	2077868	EP	B1	2016-07-27	MEDELA HOLDING AG		
	34	2016164853	WO	A1	2016-10-13	NAYA HEALTH, INC.		
	35	1263487	EP	B2	2016-11-23	MEDELA HOLDING AG		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	36	2017061349	WO	A1	2017-04-13	MURATA MANUFACTURING CO., LTD.		
	37	2017108555	WO	A1	2017-06-29	KONINKLIJKE PHILIPS N.V.		
	38	2017139480	WO	A1	2017-08-17	EXPLORAMED NC7, INC.		

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Whisper Wear Hands-Free Breast Pump, Model: WWPMP01, User Guide, pps. 1-20, Distributed with product at least as early as 2007 (see https://web.archive.org/web/20070621162539/http://www.whisperwear.com/pump_single.html)	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

✓ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark D. Simpson/	Date (YYYY-MM-DD)	2021-03-16
Name/Print	Mark D Simpson	Registration Number	32942

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Filer:	Mark D. Simpson/Lynn White
Attorney Docket Number:	373499.00050

Filed as Small Entity

Filing Fees for **Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	80	80
UTILITY SEARCH FEE	2111	1	350	350
UTILITY EXAMINATION FEE	2311	1	400	400
REQUEST FOR PRIORITIZED EXAMINATION	2817	1	2100	2100
Pages:				
UTILITY APPL SIZE FEE PER 50 SHEETS >100	2081	1	210	210
Claims:				
CLAIMS IN EXCESS OF 20	2202	10	50	500

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous-Filing:				
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**3710**

Electronic Acknowledgement Receipt

EFS ID:	42195849
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	78905
Filer:	Mark D. Simpson/Lynn White
Filer Authorized By:	Mark D. Simpson
Attorney Docket Number:	373499.00050
Receipt Date:	16-MAR-2021
Filing Date:	
Time Stamp:	15:47:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$3710
RAM confirmation Number	E20213FF48171981
Deposit Account	504364
Authorized User	Lynn White

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	TrackOne Request	Track_1_Request.PDF	135376 d723beb1b7848e243178db4512650a5737 2980af	no	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Application Data Sheet	ADS.PDF	1822787 2833a24503b35d1584c061076432765df4f 41d68	no	9

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3		Continuation_as_filed.PDF	439374 9e81433eccf9d4e563545a5237573f84e471 4e05	yes	126

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	121
Claims	122	125
Abstract	126	126

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Drawings-other than black and white line drawings	Figs_as_filed.PDF	7248994 dd8a02bde993a389fd699c5d98244e20a84 d91cd	no	44

Warnings:

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

5		Decs_and_POA.PDF	236689 25e4ff64342b479b953e8a937054b7c94bfca5f4	yes	4

Multipart Description/PDF files in .zip description

Document Description	Start	End
Oath or Declaration filed	1	3
Power of Attorney	4	4

Warnings:

Information:

6	Transmittal Letter	IDS_TM.PDF	95501 20d7a253deb99d1b9adc0dd7f548fb4991bc5212	no	1

Warnings:

Information:

7	Information Disclosure Statement (IDS) Form (SB08)	IDS.PDF	1038616 8b612b75ebec1ae1cd8830bd01051456339581d9	no	15

Warnings:

Information:

8	Fee Worksheet (SB06)	fee-info.pdf	43202 3e05af36d443e601c1c66622d7aa35ca9c73f925	no	2

Warnings:

Information:

Total Files Size (in bytes):	11060539

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/AIA/424 (04-14)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Jonathan O'TOOLE	Nonprovisional Application Number (if known):	
Title of Invention:	BREAST PUMP SYSTEM		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. ☑ **Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ **Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Mark D. Simpson/	Date 2021-03-16
Name (Print/Typed) Mark D. Simpson	Practitioner Registration Number 32942

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☑ *Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	

Title of Invention	BREAST PUMP SYSTEM

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jonathan		O'TOOLE	

Residence Information (Select One) ○ US Residency ● Non US Residency ○ Active US Military Service

City	London	Country of Residence i	GB

Mailing Address of Inventor:

Address 1	c/o Chiaro Technology Limited		
Address 2	63-66 Hatton Garden		
City	London	**State/Province**	
Postal Code	EC1N 8LE	**Country** i	GB

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Adam		ROLLO	

Residence Information (Select One) ○ US Residency ● Non US Residency ○ Active US Military Service

City	London	Country of Residence i	GB

Mailing Address of Inventor:

Address 1	c/o Chiaro Technology Limited		
Address 2	63-66 Hatton Garden		
City	London	**State/Province**	
Postal Code	EC1N 8LE	**Country** i	GB

Inventor 3 Remove

Legal Name

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	
Title of Invention	BREAST PUMP SYSTEM	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Andrew		CARR	

Residence Information (Select One) US Residency ◉ Non US Residency Active US Military Service

City	London	Country of Residence i	GB

Mailing Address of Inventor:

Address 1	c/o Chiaro Technology Limited		
Address 2	63-66 Hatton Garden		
City	London	**State/Province**	
Postal Code	EC1N 8LE	**Country** i	GB

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	78905
Email Address	patents@saul.com

Add Email Remove Email

Application Information:

Title of the Invention	BREAST PUMP SYSTEM		
Attorney Docket Number	373499.00050	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	44	**Suggested Figure for Publication (if any)**	1

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country i

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	
Title of Invention	BREAST PUMP SYSTEM	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	◯ Limited Recognition (37 CFR 11.9)
Customer Number	78905		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	17181057	2021-02-22
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
17181057	Continuation of	16009547	2018-06-15

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	
Title of Invention	BREAST PUMP SYSTEM	

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
1709561.3	GB	2017-06-15	1DE1
1709564.7	GB	2017-06-15	B3B5
1709566.2	GB	2017-06-15	D6F6
1809036.5	GB	2018-06-01	D82C

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	

Title of Invention	BREAST PUMP SYSTEM

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	373499.00050
		Application Number	
Title of Invention	BREAST PUMP SYSTEM		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:	
If the Applicant is an Organization check here.	☒
Organization Name	CHIARO TECHNOLOGY LIMITED

Mailing Address Information For Applicant:

Address 1	63-66 Hatton Garden		
Address 2			
City	London	**State/Province**	
Country	GB	Postal Code	EC1N 8LE
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	
Title of Invention	BREAST PUMP SYSTEM	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the <u>INITIAL</u> filing of the application <u>and</u> either box A or B is <u>not</u> checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **<u>must</u>** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **<u>all</u>** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **<u>all</u>** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Mark D. Simpson/			Date (YYYY-MM-DD)	2021-03-16
First Name	Mark D.	Last Name	Simpson	Registration Number	32942

Additional Signature may be generated within this form by selecting the Add button. Add

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	373499.00050
	Application Number	

Title of Invention	BREAST PUMP SYSTEM

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

BREAST PUMP SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation of U.S. Application No. 17/181,057, filed on February 22, 2021, which is a U.S. Application No. 16/009,547, filed on June 15, 2018, which is based on, and claims priority to, GB Application No. 1709561.3, filed June 15, 2017; GB Application No. 1709564.7, filed on June 15, 2017; GB Application No. 1709566.2, filed on June 15, 2017; and GB Application No. 1809036.5, filed on June 1, 2018, the entire contents of each of which being fully incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of the invention relates to a breast pump system; one implementation of the system is a wearable, electrically powered breast pump system for extracting milk from a mother.

2. Description of the Prior Art

The specification of the present disclosure is broad and deep. We will now describe the prior art in relation to key aspects of the present disclosure.

Prior art related to breast pump systems

A breast pump system is a mechanical or electro-mechanical device that extracts milk from the breasts of a lactating woman.

A typical breast pump design is as shown in WO 96/25187 A1. A large suction generating device is provided, which is freestanding. This is attached by air lines to one

or two breast shields which engage with the user's breasts. A pressure cycle is applied from the suction generating device, via the air lines, to the breast shields. This generates a pressure cycle on the user's breasts to simulate the suction generated by a feeding child.

The suction generating device is a large component that connects to mains power to operate the pumps therein. Milk collection bottles are provided to store the expressed breast milk. In the system of WO 96/36298 A1 separate bottles are provided attached to each breast shield. A single bottle with tubing connecting to each breast shield may also be used. But for a mother to use this discretely, such as in an office environment, specialised bras must be used. In particular, breast-pumping bras which have a central slit, for the nipple tunnel of the breast shield to extend through, are typically used. The breast shield is held within the bra, with the suction generating device and milk bottle outside the bra.

The fundamental breast pump system has not significantly evolved from this approach, only minor technical improvements have been made.

However, these systems present a number of significant disadvantages. As the suction generating device is a large freestanding unit connected to mains power, the user may feel tethered to the wall. The known devices typically also require a specific user posture and undressing to function normally. This is obviously difficult for a user to do discretely, such as in an office setting. The known devices are also typically noisy, uncomfortable, and hard to clean.

Fully integrated wearable breast pump systems have begun to enter the market, such as described in US 2016 0206794 A1. In such pump systems, the suction source, power supply and milk container are contained in a single, wearable device; there is no need for bulky external components or connections. Such devices can be provided with a substantially breast shaped convex profile so as to fit within a user's bra for discrete pumping, as well as pumping on-the-go without any tethers to electrical sockets or collection stations. The internal breast shield is naturally convex to fit over a breast.

In US 2016 0206794 A1, when viewed from the front, the breast pump device has a 'tear-drop' rounded shape, fuller at its base than at its top. But it uses collapsible bags as

milk collection devices. As the collection bag systems are collapsible, it can be difficult for a user to extract all of their milk from the bag, due to the small cut opening that is needed and the capillary action between the bonded plastic sheets that form the bag. This waste can be disheartening for the user, as this is food for their child. The bags are also not re-usable, so the user is required to purchase and maintain a stock of these. As well as presenting a recurring cost, if the user runs out of stock they are unable to use the product until more bags are purchased.

Furthermore, as a result of the collapsible bags, a complex and somewhat noisy pumping arrangement is necessary. In particular, the breast shield connects to a tube which is provided with compression units which "step" the expressed milk through the tube to the collection bag. This uses the breast milk as a hydraulic fluid to generate suction on the breast. In order to carry this out, a complex sequenced pulsing arrangement must be implemented.

In addition to these systems being particularly complex and wasteful, only a relatively small bag can be used. In US 2016 206794, approximately 110 ml (4 fluid ounces) of milk can be collected before the bag must be changed. While this may be sufficient for some users, others may produce much more milk in a session.

A further integrated wearable breast pump system is shown in US 2013 0023821 A1. In the third embodiment in this document, the breast pump system includes a motor driven vacuum pump and power source. An annular (or punctured disc) membrane is provided, with the flow path of the milk going through the centre of the annulus. The membrane is housed in separate housing and is sealed at its inner and outer edges. The breast shield has a small protrusion to engage with these housing components. However, the design of this breast pump system results in a number of problems. The use of an annular membrane, with the fluid flow path running through the opening of the annulus is undesirable as it results in a large and bulky device. There is therefore a need for improved integrated breast pump systems.

Prior Art related to liquid measurement systems

In the context of breast pump systems, it is useful to measure the quantity of expressed milk. One way to do this is to have a clear container for the breast pump, through which

the level of expressed milk inside the container can be seen. However, viewing the milk bottle is not always possible, for example in a breast pump that collects milk while being worn inside a maternity bra.

An existing apparatus for detecting the level of liquid inside a container of a breast pump is that disclosed in US 2016/296681. In this apparatus, a sensing mechanism is provided at the top of a container, which detects droplets of liquid, specifically breast milk, entering the container. By detecting these droplets entering the container, the apparatus can determine the quantity of liquid which enters the container. In this apparatus, an accurate indication of the level of liquid in the container is reliant on the sensing mechanism being able to accurately record every droplet entering the container.

Particularly at times when liquid enters the container at a high flow rate, this accuracy cannot be guaranteed, leading to significant cumulative errors. An accurate indication of the level of liquid in the container in this apparatus is also reliant on the sensing mechanism always being on during the pumping process, so that power consumption of the sensing mechanism is correspondingly high.

In view of the above, there is the need for an improved way to determine the level of liquid inside a container connected to a breast pump.

Prior Art related to bra clips

Many specialised bras (or brassieres) exist for maternity use and that facilitate nursing and/or breast pumping for milk collection, without the need to remove the bra itself. In a traditional nursing bra, this is achieved with the use of an at least partially detachable cup, which can be unhooked for feeding and/or pumping.

Further specialised bras are known which are provided with cut-out portions or slits which substantially align with the wearer's areola and nipple. Traditional breast pump systems comprise an elongate breast shield which extends away from the breast towards an external bottle and source of suction. The breast shield is arranged to extend through the cut-out portion or slit, with the collection bottle and pumping apparatus placed outside of the bra. These systems require the user to remove or unbutton any over-garments, and are uncomfortable when not pumping.

Integrated, wearable breast pump systems have begun to enter the market, such as previously noted US 2016 0206794 A1. In such pumps, the suction source, power supply and milk container are all in a single, wearable device, as noted above, without the need for bulky external components or connections. Such devices can be provided with a substantially breast shaped profile so as to fit within a user's bra for discrete pumping, as well as pumping on-the-go without any tethers to electrical sockets or collection stations.

Maternity (or nursing) bras such as disclosed in US 4,390,024 A have partially detachable cups, with several hooks provided along the bra strap for attaching the cups to the strap. The cups can then be attached to different hooks in order to adjust the bra strap length. However, these attachment points are fixed. Additionally, this bra has been designed to accommodate the change in breast size before and after the feeding/pumping process. It is not designed to accommodate a breast pump. Accordingly, there is a need for a better system to accommodate integrated wearable breast pumps.

SUMMARY OF THE INVENTION

The invention is a wearable breast pump system including: a housing shaped at least in part to fit inside a bra; a piezo air-pump fitted in the housing and forming part of a closed loop system that drives a separate, deformable diaphragm to generate negative air pressure, that diaphragm being removably mounted on a breast shield.

BRIEF DESCRIPTION OF THE FIGURES

Aspects of the invention will now be described, by way of example(s), with reference to the following Figures, which each show features of various implementations of the invention including optional features that may be utilised:

Figure 1 is a front view of an assembled breast pump system.

Figure 2 is a rear view of the assembled breast pump system of Figure 1.

Figure 3 is a front view of a partially disassembled breast pump system.

Figure 4 is a rear view of the partially disassembled breast pump system of Figure 3.

Figure 5 is a front view of a further partially disassembled breast pump system.

Figure 6 is a rear view of the further partially disassembled breast pump system of Figure 5.

Figure 7 is a front view of the breast pump system of Figure 1, with the outer shell translucent for ease of explanation.

Figure 8 is a further front view of the breast pump system of Figure 1, with the front of the outer shell removed for ease of explanation.

Figure 9 is a schematic view of a nipple tunnel for a breast shield.

Figure 10 is a schematic of a pneumatic system for a breast pump system.

Figure 11 is a schematic of an alternative pneumatic system for a breast pump system.

Figure 12 is a schematic of a further alternative pneumatic system for a breast pump system.

Figure 13 is a graph depicting measured pressure in the breast pump system of Figure 12 over time.

Figure 14 shows schematics for breast shield sizing and nipple alignment.

Figure 15 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 16 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 17 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 18 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 19 shows a screenshot of an application running on a device connected to the

breast pump system.

Figure 20 shows a screenshot of an application running on a connected device.

Figure 21 shows a screenshot of an application running on a connected device.

Figure 22 shows a screenshot of an application running on a connected device.

Figure 23 shows a screenshot of an application running on a connected device.

Figure 24 shows a screenshot of an application running on a connected device.

Figure 25 shows a screenshot of an application running on a connected device.

Figure 26 shows a diagram of a breast pump sensor network,

Figure 27 shows a sectional view of a device being used to determine the level of liquid in a container;

Figure 28 shows a sectional view of the device and the container from Figure 27 being used at a different orientation.

Figure 29 shows a sectional view of the device and the container from Figure 27 being used whilst undergoing acceleration.

Figure 30 shows a sectional view of the device from Figure 27 being used as part of a breast pump assembly.

Figure 31 shows a sectional view of a device connected between a container and its lid, and which is operable to determine the level of liquid inside the container.

Figure 32 depicts a prior art design for a maternity bra;

Figure 33 depicts a clip and clasp being fitted to a maternity bra.

Figure 34 depicts an alternative clip for adjustment of a maternity bra.

Figure 35 depicts the alternative clip of Figure 34.

Figure 36 depicts an alternative clip for adjustment of a maternity bra.

Figure 37 depicts an alternative clip for adjustment of a maternity bra.

Figure 38 depicts an alternative clip for adjustment of a maternity bra.

Figure 39 depicts adjustment of the maternity bra of Figure 37.

Figure 40 shows a configuration with two piezo pumps mounted in series.

Figure 41 shows a configuration of two piezo pumps mounted in parallel.

Figure 42 shows a plot of the air pressure generated as a function of time by two piezo pumps mounted in series and mounted in parallel respectively.

Figure 43 shows a plot of the air pressure generated as a function of time by two piezo pumps mounted in a dual configuration.

Figure 44 shows a figure of a pump including two piezo pumps in which each piezo pump is connected to a heat sink.

DETAILED DESCRIPTION

We will now describe an implementation of the invention, called the Elvie™ pump, in the following sections:

Section A: The Elvie™ Breast Pump System

Section B: An IR System

Section C: A Bra Clip

Section D: Piezo Pumps and Wearable Devices

Section A: The Elvie™ Breast Pump System

1. Elvie™ Breast Pump System Overview

An implementation of the invention, called the Elvie™ pump, is a breast pump system that is, at least in part, wearable inside a bra. The breast pump system comprises a breast shield for engagement with the user's breast, a housing for receiving at least a portion of the breast shield and a detachable rigid milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user, with a milk-flow pathway defined from an opening in the breast shield to the milk collection container. The housing inside also includes a pump for generating a negative pressure in the breast shield, as well as battery and control electronics Unlike other wearable breast pumps, the only parts of the system that come into contact with milk in normal use are the breast shield and the milk container; milk only flows through the breast shield and then directly into the milk container. Milk does not flow through any parts of the housing at all, for maximum hygiene and ease of cleaning.

With reference to Figure 1 and Figure 2, the assembled breast pump system 100 includes a housing 1 shaped to substantially fit inside a bra. The housing 1 includes one or more pumps and a rechargeable battery. The breast pump system includes two parts that are directly connected to the housing 1: the breast shield 7 and a milk container 3. The breast shield 7 and the milk container 3 are directly removable or attachable from the housing 1 in normal use or during normal dis-assembly (most clearly shown in Figure 5). All other parts that are user-removable in normal use or during normal dis-assembly are attached to either the breast shield 7 or the milk container 3. The breast shield 7 and milk container 3 may be removed or attached for example using a one click or one press action or a push button or any other release mechanism. Audible and/or haptic feedbacks confirm that the pump is properly assembled.

The modularity of the breast pump allows for easy assembly, disassembly and replacement of different parts such as the breast shield and milk collection container. This also allows for different parts of the pump to be easily washed and/or sterilised. The breast shield and bottle assembly, both of which are in contact with milk during

pumping, may therefore be efficiently and easily cleaned; these are the only two items that need to be cleaned; in particular, the housing does not need to be cleaned.

The housing 1, breast shield 7 that is holding a flexible diaphragm, and milk container 3 attach together to provide a closed-loop pneumatic system powered by piezoelectric pumps located in the housing 1. This system then applies negative pressure directly to the nipple, forms an airtight seal around the areola, and provides a short path for expressed milk to collect in an ergonomically shaped milk container 3.

The different parts of the breast shield system are also configured to automatically self-seal under negative pressure for convenience of assembly and disassembly and to reduce the risk of milk spillage. Self-sealing refers to the ability of sealing itself automatically or without the application of adhesive, glue, or moisture (such as for example a self-sealing automobile tire or self-sealing envelopes). Hence once the breast pump system is assembled it self-seals under its assembled condition without the need to force seals into interference fits to create sealed chambers. A degree of interference fitting is usual however, but is not the predominating attachment mechanism. Self-sealing enables simple components to be assembled together with a light push: for example, the diaphragm just needs to be placed lightly against the diaphragm housing; it will self-seal properly and sufficiently when the air-pump applies sufficient negative air-pressure. The diaphragm itself self-seals against the housing when the breast shield is pushed into the housing. Likewise, the breast shield self-seals against the milk container when the milk container is pushed up to engage the housing. This leads to simple and fast assembly and dis-assembly, making it quick and easy to set the device up for use, and to clean the device after a session.

Self-sealing has a broad meaning and may also relate to any, wholly or partly self-energising seals. It may also cover any interference seals, such as a press seal or a friction seal, which are achieved by friction after two parts are pushed together.

Whilst one particular embodiment of the invention's design and a specific form of each of the parts of the breast pump system is detailed below, it can be appreciated that the overall description is not restrictive, but an illustration of topology and function that the design will embody, whilst not necessary employing this exact form or number of

discrete parts.

The breast pump system 100 comprises a housing 1 and a milk collection container (or bottle) 3. The housing 1 (including the one or more pumps and a battery) and the container 3 are provided as a unit with a convex outer surface contoured to fit inside a bra. The milk collection container 3 is attached to a lower face 1A of the housing 1 and forms an integral part of the housing when connected, such that it can be held comfortably inside a bra. While the breast pump 100 may be arranged to be used with just the right or the left breast specifically, the breast pump 100 is preferably used with both breasts, without modification. To this end, the outer surfaces of the breast pump 100 are preferably substantially symmetrical.

Preferably, the width of the complete breast pump device (housing 1 and milk container 3) is less than 110 mm and the height of the complete breast pump device is less than 180 mm.

Overall, the breast pump system 100 gives discrete and comfortable wear and use. The system weighs about 224 grams when the milk container is empty, making it relatively lighter as compared to current solutions; lightness has been a key design goal from the start, and has been achieved through a lightweight piezo pump system and engineering design focussed on minimising the number of components.

The breast pump system 100 is small enough to be at least in part held within any bra without the need to use a specialized bra, such as a maternity bra or a sports bra. The rear surface of the breast pump is also concave so that it may sit comfortably against the breast. The weight of the system has also been distributed to ensure that the breast pump is not top heavy, ensuring comfort and reliable suction against the breast. The centre of gravity of the pump system is, when the container is empty, substantially at or below the horizontal line that passes through the filling point on the breast shield, so that the device does not feel top-heavy to a person while using the pump.

Preferably, when the container is empty, the centre of gravity is substantially at or below the half-way height line of the housing so that the device does not feel top-heavy to a user using the pump.

The centre of gravity of the breast pump, as depicted by Figure 1, is at around 60mm high on the centreline from the base of the breast pump when the milk container is empty. During normal use, and as the milk container gradually receives milk, the centre of gravity lowers, which increases the stability of the pump inside the bra. It reduces to around 40mm high on the centreline from the base of the breast pump when the milk container is full.

The centre of gravity of the breast pump is at about 5.85mm below the centre of the nipple tunnel when the milk container is empty, and reduced to about 23.60mm below the centre of the nipple tunnel when the milk container is full. Generalising, the centre of gravity should be at least 2mm below the centre of the nipple tunnel when the container is empty.

The breast pump 100 is further provided with a user interface 5. This may take the form of a touchscreen and/or physical buttons. In particular, this may include buttons, sliders, any form of display, lights, or any other componentry necessary to control and indicate use of the breast pump 100. Such functions might include turning the breast pump 100 on or off, specifying which breast is being pumped, increasing or decreasing the peak pump pressure. Alternatively, the information provided through the user interface 5 might also be conveyed through haptic feedback, such as device vibration, driven from a miniature vibration motor within the pump housing 1.

In the particular embodiment of the Figures, the user interface 5 comprises power button 5A for turning the pump on and off. The user interface 5 further comprises pump up button 5B and pump down button 5C. These buttons adjust the pressure generated by the pump and hence the vacuum pressure applied to the user's breast. In preferable embodiments, the pump up button 5B could be physically larger than the pump down button 5C. A play/pause button 5D is provided for the user to interrupt the pumping process without turning the device off.

The user interface 5 further comprises a breast toggle button 5E for the user to toggle a display of which breast is being pumped. This may be used for data collection, e.g. via an application running on a connected smartphone; the app sends data to a remote server, where data analysis is undertaken (as discussed in more detail later), or for the user to keep track of which breast has most recently been pumped. In particular, there may be a

pair of LEDs, one to the left of the toggle button 5E and one to the right. When the user is pumping the left breast, the LED to the right of the toggle button 5E will illuminate, so that when the user looks down at the toggle it is the rightmost LED from their point of view that is illuminated. When the user then wishes to switch to the right breast, the toggle button can be pressed and the LED to the left of the toggle button 5E, when the user looks down will illuminate. The connected application can automatically track and allocate how much milk has been expressed, and when, by each breast.

The breast pump system also comprises an illuminated control panel, in which the level of illumination can be controlled at night or when stipulated by the user. A day time mode, and a less bright night time mode that are suitable to the user, are available. The control of the illumination level is either implemented in hardware within the breast pump system itself or in software within a connected device application used in combination with the breast pump system.

As depicted in Figure 1, the housing 1 and milk collection container 3 form a substantially continuous outer surface, with a generally convex shape. This shape roughly conforms with the shape of a 'tear-drop' shaped breast. This allows the breast pump 100 to substantially fit within the cup of a user's bra. The milk collection container 3 is retained in attachment with the housing 1 by means of a latch system, which is released by a one-click release mechanism such as a push button 2 or any other one-handed release mechanism. An audible and/or haptic feedback may also be used to confirm that the milk collection container 3 has been properly assembled.

The European standard EN 13402 for Cup Sizing defines cup sizes based upon the bust girth and the underbust girth of the wearer and ranges from AA to Z, with each letter increment denoting an additional 2 cm difference. Some manufacturers do vary from these conventions in denomination, and some maternity bras are measured in sizes of S, M, L, XL, etc. In preferred embodiments, the breast pump 100 of the present invention corresponds to an increase of between 3 or 4 cup sizes of the user according to EN 13402.

A plane-to-plane depth of the breast pump can also be defined. This is defined as the distance between two parallel planes, the first of which is aligned with the innermost

point of the breast pump 100, and the second of which is aligned with the outermost point of the breast pump 100. This distance is preferably less than 100 mm.

Figure 2 is a rear view of the breast pump 100 of Figure 1. The inner surface of the housing 1 and milk collection container 3 are shown, along with a breast shield 7. The housing 1, milk collection container 3 and breast shield 7 form the three major subcomponents of the breast pump system 100. In use, these sub-components clip together to provide the functioning breast pump system 100. The breast shield 7 is designed to engage with the user's breast, and comprises a concave inner flange 7A which contacts the breast. To allow the breast pump 100 to be used on either of the user's breasts, the breast shield 7 is preferably substantially symmetrical on its inner flange 7A.

The inner flange 7A is substantially oval-shaped. While the inner flange 7A is concave, it is relatively shallow such that it substantially fits the body form of the user's breast. In particular, when measured side-on the inner-most point of the flange 7A and the outer-most point may be separated by less than 25 mm. By having a relatively shallow concave surface, the forces applied can be spread out over more surface area of the breast. The flatter form also allows easier and more accurate location of the user's nipple. In particular, the flange 7A of the breast shield 7 may extend over the majority of the inner surface of the housing 1 and milk collection container 3. Preferably, it may extend over 80% of this surface. By covering the majority of the inner surface, the breast shield is the only component which contact's the wearer's breast. This leaves fewer surfaces which require thorough cleaning as it reduces the risk of milk contacting a part of the device which cannot be easily sterilized. Additionally, this also helps to disperse the pressure applied to the user's breast across a larger area.

The breast shield 7 substantially aligns with the outer edge 1B of the housing 1. The milk collection container 3 may be provided with an arcuate groove for receiving a lower part of the breast shield 7. This is best shown in later Figures. In the assembled arrangement of Figures 1 and 2, the inner surface of the breast pump 100 is substantially continuous.

The breast shield 7 comprises a shield flange for engaging the user's breast, and an elongate nipple tunnel 9) aligned with the opening and extending away from the user's

breast. Breast shield nipple tunnel 9 extends from a curved section 7B in the breast shield 7. In preferable embodiments the nipple tunnel 9 is integral with the breast shield 7. However, it is appreciated that separate removable/interchangeable nipple tunnels may be used. Curved section 7B is positioned over the user's nipple and areola in use. The breast shield 7 forms an at least partial seal with the rest of the user's breast around this portion, under the negative air pressure created by an air-pressure pump.

This breast shield nipple tunnel 9 defines a milk-flow path from the inner surface of the breast shield 7A, through the breast shield nipple tunnel 9 and into the milk collection container 3. The breast shield nipple tunnel 9 is preferably quite short in order to minimise the length of the milk-flow path in order to minimise losses. By reducing the distance covered by the milk, the device is also reduced in size and complexity of small intermediate portions. In particular, the breast shield nipple tunnel 9 may extend less than 70 mm from its start to end, more preferably less than 50 mm. In use, the nipple tunnel 9 is substantially aligned with the user's nipple and areolae. The nipple tunnel comprises a first opening 9A for depositing milk into the collection container and a second opening 19A for transferring negative air pressure generated by the pump to the user's nipple.

The shield flange 7A and nipple tunnel 9 may be detachable from the housing 1 together. The shield flange 7A and nipple tunnel 9 being detachable together helps further simplify the design, and reduce the number of components which must be removed for cleaning and sterilization. However, preferably, the nipple tunnel 9 will be integral with the breast shield 7, in order to simplify the design and reduce the number of components which must be removed for cleaning and sterilisation.

Figures 3 and 4 are of a partially disassembled breast pump 100 of the present invention. In these Figures, the breast shield 7 has been disengaged from the housing 1 and milk collection bottle 3. As shown in Figure 4, the housing 1 comprises a region or slot 11 for receiving the breast shield nipple tunnel 9 of the breast shield 7. The breast shield is held in place thanks to a pair of channels (9B) included in the nipple tunnel 9, each channel including a small indent. When pushing the housing 1 onto the breast shield 7, which has been placed over the breast, ridges in the housing (9C) engage with the channels, guiding the housing into position; a small, spring plunger, such as ball bearing in each

ridge facilitates movement of the housing on to the nipple tunnel 9. The ball bearings locate into the indent to secure the housing on to the nipple tunnel with a light clicking sound. In this way, the user can with one hand place and position the breast shield 7 onto her breast and with her other hand, position and secure the housing 1 on to the breast shield 7. The breast shield 7 can be readily separated from the housing 1 since the ball bearing latch only lightly secures the breast shield 7 to the housing 1.

Alternatively, the breast shield 7 may also be held in place by means of a clip engaging with a slot located on the housing. The clip may be placed at any suitable point on the shield 7, with the slot in a corresponding location.

The breast shield nipple tunnel 9 of the breast shield 7 is provided with an opening 9A on its lower surface through which expressed milk flows. This opening 9A is configured to engage with the milk collection bottle 3.

The breast pump 100 further comprises a barrier or diaphragm for transferring the pressure from the pump to the milk-collection side of the system. In the depicted example, this includes flexible rubber diaphragm 13 seated into diaphragm housing 19A. The barrier could be any other suitable component such as a filter or an air transmissive material. Diaphragm housing 19A includes a small air hole into the nipple tunnel 9 to transfer negative air pressure into nipple tunnel 9 and hence to impose a sucking action on the nipple placed in the nipple tunnel 9.

Hence, the air pump acts on one side of the barrier or diaphragm 13 to generate a negative air pressure on the opposite, milk-flow side of the barrier. The barrier has an outer periphery or surface, i.e. the surface of diaphragm housing 19A that faces towards the breast, and the milk-flow pathway extends underneath the outer periphery or surface of the barrier or diaphragm housing 19A. The milk-flow path extending under the outer periphery or surface of the barrier 19A allows for a simpler and more robust design, without the milk-flow pathway extending through the barrier. This provides increased interior space and functionality for the device.

As noted, the milk-flow pathway extends beneath or under the barrier 13 or surface of diaphragm housing 19A. This provides an added benefit of having gravity move the milk down and away from the barrier.

Preferably the milk-flow pathway does not pass through the barrier 32. This results in a simpler and smaller barrier design.

As noted, the diaphragm 13 is mounted on diaphragm housing 19A that is integral to the breast shield. This further helps increase the ease of cleaning and sterilisation as all of the components on the "milk" flow side can be removed.

The barrier 13 may also provide a seal to isolate the air pump from the milk-flow side of the barrier. This helps to avoid the milk becoming contaminated from the airflow or pumping side (i.e. the non-milk-flow side).

Alternatively, the only seal is around an outer edge of the barrier 13. This is a simple design as only a single seal needs to be formed and maintained. Having multiple seals, such as for an annular membrane, introduces additional complexity and potential failure points.

As illustrated in Figures 3 and 4, the barrier may include a flexible diaphragm 13 formed by a continuous circular disc shaped membrane which is devoid of any openings or holes. This provides a larger effective "working" area of the diaphragm (i.e. the area of the surface in contact with the pneumatic gasses) than an annular membrane and hence the membrane may be smaller in diameter to have the same working area.

The diaphragm 13 is arranged so that the milk-flow pathway extends below and past the outer surface or periphery of the diaphragm 13. This means that the milk-flow pathway does not extend through the diaphragm 13. In particular, the milk-flow pathway is beneath the diaphragm 13. However, the diaphragm 13 may be offset in any direction with respect to the milk-flow pathway, provided that the milk-flow pathway does not extend through the diaphragm 13.

Preferably, the diaphragm 13 is a continuous membrane, devoid of any openings. The diaphragm 13 is held in a diaphragm housing 19, which is formed in two parts. The first half 19A of the diaphragm housing 19 is provided on the outer surface of the breast shield 7, above the breast shield nipple tunnel 9 and hence the milk-flow pathway. In

preferred embodiments, the first half 19A of the diaphragm housing 19 is integral with the breast shield. The second half 19B of the diaphragm housing is provided in a recessed portion of the housing 1. The diaphragm 13 self-seals in this diaphragm housing 19 around its outer edge, to form a watertight and airtight seal. Preferably, the self-seal around the outer edge of the diaphragm 13 is the only seal of the diaphragm 13. This is beneficial over systems with annular diaphragms which must seal at an inner edge as well. Having the diaphragm 13 mounted in the breast pump 100 in this manner ensures that it is easily accessible for cleaning and replacement. It also ensures that the breast shield 7 and diaphragm 13 are the only components which need to be removed from the pump 100 for cleaning. Because the diaphragm 13 self-seals under vacuum pressure, it is easily removed for cleaning when the device is turned off.

Figures 5 and 6 show a breast pump 100 according to the present invention in a further disassembled state. In addition to the breast shield 7 and diaphragm 13 being removed, the milk collection container 3 has been unclipped. Preferably, the milk collection container 3 is a substantially rigid component. This ensures that expressed milk does not get wasted, while also enhancing re-usability. In some embodiments, the milk collection container 3 may be formed of three sections: a front bottle potion, a rear bottle potion, and a cap. These three sections may clip together to form the milk collection container 3. This three-part system is easy to empty, easily cleanable since it can be dis-assembled, and easily re-usable. The milk collection container or milk bottle may be formed of at least two rigid sections which are connectable. This allows simple cleaning of the container for re-use. Alternatively, the container may be a single container made using a blow moulding construction, with a large opening to facilitate cleaning. This large opening is then closed with a cap with an integral spout 35 or 'sealing plate' (which is bayonet-mounted and hence more easily cleaned than a threaded mount spout). A flexible rubber valve 37 (or 'sealing plate seal') is mounted onto the cap or spout 35 and includes a rubber duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump; this ensures that negative air-pressure does not need to be applied to the milk container and hence adds to the efficiency of the system. The flexible valve 37 self-seals against opening 9A in nipple tunnel 9. Because it self-seals under vacuum pressure, it automatically releases when the system is off, making it easy to remove the milk container.

Preferably, the milk collection container resides entirely below the milk flow path defined by the breast shield when the breast pump system 100 is positioned for normal use, hence ensuring fast and reliable milk collection.

The milk collection container 3 has a capacity of approximately 5 fluid ounces (148 ml). Preferably, the milk collection container has a volume of greater than 120 ml. More preferably, the milk collection container has a volume of greater than 140 ml. To achieve this, the milk collection container 3 preferably has a depth in a direction extending away from the breast in use, of between 50 to 80 mm, more preferably between 60 mm to 70 mm, and most preferably between 65 mm to 68 mm.

The milk collection container 3 further preferably has a height, extending in the direction from the bottom of the container 3 in use to the cap or spout or sealing plate 35, of between 40 mm to 60 mm, more preferably between 45 mm to 55 mm, and most preferably between 48 mm to 52 mm. The cap 35 may screw into the milk collection bottle 3. In particular, it may be provided with a threaded connection or a bayonet and slot arrangement.

Further preferably, the milk collection container has a length, extending from the leftmost point to the rightmost point of the container 3 in use, of between 100 mm to 120 30 mm, more preferably between 105 mm to 115 mm, and most preferably between 107 mm to 110 mm.

This cap 35 is provided with a one-way valve 37, through which milk can flow only into the bottle. This valve 37 prevents milk from spilling from the bottle once it has been collected. In addition, the valve 37 automatically seals completely unless engaged to the breast shield 7. This ensures that when the pump 100 is dismantled immediately after pumping, no milk is lost from the collection bottle 3. It can be appreciated that this one-way valve 37 might also be placed on the breast shield 7 rather than in this bottle cap 35.

Alternatively, the milk bottle 3 may form a single integral part with a cap 35. Cap 35 may include an integral milk pouring spout.

In certain embodiments, a teat may be provided to attach to the annular protrusion 31A

or attach to the spout that is integral with cap 35, to allow the container 3 to be used directly as a bottle. This allows the milk container to be used directly as a drinking vessel for a child. The milk collection container may also be shaped with broad shoulders such that it can be adapted as a drinking bottle that a baby can easily hold.

Alternatively, or in addition, a spout may be provided to attach to the protrusion 31A for ease of pouring. A cap may also be provided to attach to the protrusion 31A in order to seal the milk collection bottle 3 for easy storage.

The pouring spout, drinking spout, teat or cap may also be integral to the milk collection container.

Further, the removable milk collection container or bottle includes a clear or transparent wall or section to show the amount of milk collected. Additionally, measurement markings (3A) may also be present on the surface of the container. This allows the level of milk within the container to be easily observed, even while pumping. The milk collection container or bottle may for example be made using an optically clear, dishwasher safe polycarbonate material such as Tritan™.

The milk collection container or bottle may include a memory or a removable tag, such as a tag including an NFC chip, that is programmed to store the date and time it was filled with milk, using data from the breast pump system or a connected device such as a smartphone. The container therefore includes wireless connectivity and connects to a companion app. The companion app then tracks the status of multiple milk collection containers or bottles to select an appropriate container or bottle for feeding. The tag of the bottle may also be programmed to store the expiry date of the milk as well as the quantity of the milk stored.

Figures 7 and 8 show front views of a breast pump system 100. The outer-surface of the housing 1 has been drawn translucent to show the components inside. The control circuitry 71 for the breast pump 100 is shown in these figures. The control circuitry in the present embodiment comprises four separate printed circuit boards, but it is appreciated that any other suitable arrangement may be used.

The control circuitry may include sensing apparatus for determining the level of milk in the container 3. The control circuitry may further comprise a wireless transmission device for communicating over a wireless protocol (such as Bluetooth) with an external device. This may be the user's phone, and information about the pumping may be sent to this device. In embodiments where the user interface comprises a breast toggle button 5E, information on which breast has been selected by the user may also be transmitted with the pumping information. This allows the external device to separately track and record pumping and milk expression data for the left and right breasts.

There should also be a power charging means within the control circuitry 71 for charging the battery 81. While an external socket, cable or contact point may be required for charging, a form of wireless charging may instead be used such as inductive or resonance charging. In the Figures, charging port 6 is shown for charging the battery 81. This port 6 may be located anywhere appropriate on the housing 1.

Figure 8 shows the location of the battery 81 and the pumps 83A, 83B mounted in series inside the housing 1. While the depicted embodiment shows two pumps 83A, 83B it is appreciated that the present invention may have a single pump. Preferably, an air filter 86 is provided at the output to the pumps 83A, 83B. In preferable embodiments, the pumps 83A, 83B are piezoelectric air pumps (or piezo pumps), which operate nearly silently and with minimal vibrations. A suitable piezo pump is manufactured by TTP Ventus, which can deliver in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free flow. The rear side of the second half of the diaphragm housing 19B in the housing 1 is provided with a pneumatic connection spout. The pumps 83A, 83B are pneumatically connected with this connection spout.

Operation of the breast pump 100 will now be described. Once the breast pump 100 is activated and a pumping cycle is begun, the pumps 83A, 83B generates a negative air pressure which is transmitted via an air channel to a first side of the diaphragm 13 mounted on the diaphragm housing 19A. This side of the diaphragm 13 is denoted the pumping side 13B of the diaphragm 13.

The diaphragm 13 transmits this negative air pressure to its opposite side (denoted the milk-flow side 13A). This negative pressure is transferred through a small opening in the

diaphragm housing 19A to the breast shield nipple tunnel 9 and the curved opening 7B of the breast shield 7 that contacts the breast. This acts to apply the pressure cycle to the breast of the user, in order to express milk. The milk is then drawn through the nipple tunnel 9, to the one way valve 37 that remains closed whilst negative pressure is applied. When the negative air pressure is released, the valve 37 opens and milk flows under gravity past the valve 37 and into milk container 3. Negative air pressure is periodically (e.g. cyclically, every few seconds) applied to deliver pre-set pressure profiles such as profiles that imitate the sucking of a child.

While the depicted embodiment of the breast pump 100 is provided with two pumps, the following schematics will be described with a single pump 83. It is understood that the single pump 83 could be replaced by two separate piezo air-pumps 83A, 83B as above.

Figure 9 depicts a schematic of a further embodiment of a breast shield nipple tunnel 9 for a breast pump 100. The breast shield nipple tunnel 9 is provided with an antechamber 91 and a separation chamber 93. A protrusion 95 extends from the walls of the breast shield nipple tunnel 9 to provide a tortuous air-liquid labyrinth path through the breast shield nipple tunnel 9. In the separation chamber 93 there are two opening 97, 99. An air opening 97 is provided in an upper surface 93A of the separation chamber 93. This upper surface 93 is provided transverse to the direction of the breast shield nipple tunnel 9. This opening 97 connects to the first side of the diaphragm housing 19A and is the source of the negative pressure. This airflow opening 97 also provides a route for air to flow as shown with arrow 96. It is appreciated that the tortuous pathway is not necessary and that a breast shield nipple tunnel 9 without such a pathway will work.

The other opening 99 is a milk opening 99. The milk opening 99 is provided on a lower surface 93B of the separation chamber 93 and connects in use to the container 3. After flowing through the tortuous breast shield nipple tunnel 9 pathway, the milk is encouraged to flow through this opening 99 into the container 3. This is further aided by the transverse nature of the upper surface 93A. In this manner, expressed milk is kept away from the diaphragm 13. As such, the breast pump 100 can be separated into a "air" side comprising the pump 83, the connection spout 85 and the pumping side 13B of the diaphragm 13 and a "milk-flow" side comprising the breast shield 7, the milk collection container 3 and the milk-flow side 13A of the diaphragm 13. This ensures that all of the

"milk-flow" components are easily detachable for cleaning, maintenance and replacement. Additionally, the milk is kept clean by ensuring it does not contact the mechanical components. While the present embodiment discusses the generation of negative pressure with the pump 83, it will be appreciated that positive pressure may instead be generated.

While the embodiments described herein use a diaphragm 13, any suitable structure to transmit air pressure while isolating either side of the system may be used.

The breast pump may further comprise a pressure sensor in pneumatic connection with the piezo pump. This allows the output of the pump to be determined.

Figure 10 shows a schematic of a basic pneumatic system 200 for a breast pump 100. In the system 200 milk expressed into the breast shield 7 is directed through the breast shield nipple tunnel 9 through the torturous air-liquid labyrinth interface 95. The milk is directed through the non-return valve 37 to the collection container 3. This side of the system forms the "milk-flow" side 201.

The rest of the pneumatic system 200 forms the air side 202 and is separated from contact with milk. This is achieved by way of a flexible diaphragm 13 which forms a seal between the two sides of the system. The diaphragm 13 has a milk-flow side 13A and an air side or pumping side 13B.

The air side 202 of the system 200 is a closed system. This air side 202 may contain a pressure sensor 101 in pneumatic connection with the diaphragm 13 and the pump 83. Preferably, the pump 83 is a piezoelectric pump (or piezo pump). Due to their low noise, strength and compact size, piezoelectric pumps are ideally suited to the embodiment of a small, wearable breast pump. The pump 83 has an output 83A for generating pressure, and an exhaust to the atmosphere 83B. In a first phase of the expression cycle, the pump 83 gradually applies negative pressure to half of the closed system 202 behind the diaphragm 13. This causes the diaphragm 13 to extend away from the breast, and thus the diaphragm 13 conveys a decrease in pressure into the breast shield 7. The reduced pressure encourages milk expression from the breast, which is directed through the tortuous labyrinth system 95 and the one-way valve 37 to the collection bottle 3.

While in the depicted embodiment the air exhaust 83B is not used, it may be used for functions including, but not limited to, cooling of electrical components, inflation of the bottle to determine milk volume (discussed further later) or inflation of a massage bladder or liner against the breast. This massage bladder may be used to help mechanically encourage milk expression. More than one massage bladder may be inflated regularly or sequentially to massage one or more parts of the breast. Alternatively, the air pump may be used to provide warm air to one or more chambers configured to apply warmth to one or more parts of the breast to encourage let-down.

The air side 202 further comprises a two-way solenoid valve 103 connected to a filtered air inlet 105 and the pump 83. Alternatively, the filter could be fitted on the pump line 83A. If the filter is fitted here, all intake air is filtered but the performance of the pump may drop. After the negative pressure has been applied to the user's breast, air is bled into the system 202 through the valve 103 in a second phase of the expression cycle. In this embodiment, the air filter 105 is affixed to this inlet to protect the delicate components from degradation. In particular, in embodiments with piezoelectric components, these are particularly sensitive.

The second phase of the expression cycle and associated switching of valve 103 is actioned once a predefined pressure threshold has been reached. The pressure is detected by a pressure sensor 101.

In certain embodiments, if the elasticity and extension of the diaphragm 13 may be approximated mathematically at different pressures, the pressure measured by sensor 101 can be used to infer the pressures exposed to the nipple on the opposite side of the diaphragm 13. Figure 11 shows an alternative pneumatic system 300. The core architecture of this system is the same as the system shown in Figure 10.

In this system 300, the closed loop 202 is restricted with an additional three way solenoid valve 111. This valve 111 allows the diaphragm 13 to be selectively isolated from the rest of the closed loop 202. This additional three way valve 111 is located between the diaphragm 13 and the pump 83. The pressure sensor 101 is on the pump 83 side of the three way valve 111. The three way valve 111 is a single pole double throw (SPDT) valve,

wherein: the pole 111A is in pneumatic connection with the pump 83 and pressure sensor; one of the throws 11 is in pneumatic connection with the diaphragm 13; and the other throw 111C is in pneumatic connection with a dead-end 113. This dead-end 113 may either be a simple closed pipe, or any component(s) that does not allow the flow of air into the system 202. This could include, for example, an arrangement of one-way valves.

In this system 300, therefore, the pump 83 has the option of applying negative pressure directly to the pressure sensor 101. This allows repeated testing of the pump in order to calibrate pump systems, or to diagnose issues with the pump in what is called a dead end stop test. This is achieved by throwing the valve to connect the pump 83 to the dead end 113. The pump 83 then pulls directly against the dead end 113 and the reduction of pressure within the system can be detected by the pressure sensor 101.

The pressure sensor detects when pressure is delivered and is then able to measure the output of the pumping mechanism. The results of the pressure sensor are then sent to an external database for analysis such as a cloud database, or are fed back to an on-board microcontroller that is located inside the housing of the breast pump system.

Based on the pressure sensor measurements, the breast pump system is able to dynamically tune the operation of the pumping mechanism (i.e. the duty or pump cycle, duration of a pumping session, the voltage applied to the pumping mechanism, the peak negative air pressure) in order to ensure a consistent pressure performance across different breast pump systems.

In addition, the breast pump system, using the pressure sensor measurements, is able to determine if the pump is working correctly, within tolerance levels. Material fatigue of the pump is therefore directly assessed by the breast pump system. Hence, if the output of the pumping mechanism degrades over time, the breast pump system can tune the pumping mechanism operation accordingly. As an example, the breast pump system may increase the duration of a pumping session or the voltage applied to the pumping mechanism to ensure the expected pressures are met.

This ensures that the user experience is not altered, despite the changing output of the pump as it degrades over time. This is particularly relevant for piezo pumps where the output of the pump may vary significantly.

The microcontroller can also be programmed to deliver pre-set pressure profiles. The pressure profiles may correspond to, but not necessarily, any suction patterns that would mimic the sucking pattern of an infant. The patterns could mimic for example the sucking pattern of a breastfed infant during a post birth period or at a later period in lactation.

The profiles can also be manually adjusted by the user using a control interface on the housing of the breast pump system or on an application running on a connected device.

Additionally, the user is able to manually indicate the level of comfort that they are experiencing when they are using the system. This can be done using a touch or voice-based interface on the housing of the breast pump system itself or on an application running on a connected device.

The system stores the user-indicated comfort levels together with associated parameters of the pumping system. The pressure profiles may then be fine scaled in order to provide the optimum comfort level for a particular user.

The profiles or any of the pumping parameters may be calculated in order to correlate with maximum milk expression rate or quantity.

The pressure profiles or any of the pumping parameters may also be dynamically adjusted depending on the real time milk expression rate or quantity of milk collected. The pressure profiles or any of the pumping parameters may also be dynamically adjusted when the start of milk let-down has been detected.

Additionally, the system is also able to learn which parameters improve the breast pump system efficiency. The system is able to calculate or identify the parameters of the pumping mechanism that correlate with the quickest start of milk let-down or the highest volume of milk collected for a certain time period. The optimum comfort level for a particular user may also be taken into account.

Figure 12 shows a schematic for a system 400 for a breast pump 100 which can estimate the volume of milk collected in the collection container 3 from data collected on the air-side part 202 of the system 400.

The pump 83 is connected to the circuit via two bleed valves 126, 128. The first bleed valve 126 is arranged to function when the pump 83 applies a negative pressure. As such, this valve 126 is connected to a "bleed in" 127, for supplying atmospheric air to the system 202.

The second bleed valve 128 is arranged to function when the pump 83 applies a positive pressure. As such, this valve 128 is connected to a "bleed out" 129 for bleeding air in the system 202 to the atmosphere.

Although Section C describes the preferred embodiment for measuring or inferring the volume of milk collected in the milk collection container using IR sensors, an alternative method for measuring or inferring the volume of milk collected in the milk collection container using pressure sensors is described also below.

During a milking pump cycle, the pump 83 applies negative pressure on the air side 13B of the diaphragm 13 which causes its extension towards the pump 83. This increases the volume of the space on the milk side 13B of the diaphragm 13. This conveys the decrease in pressure to the breast to encourage expression of milk. A set of three non-return valves 121, 123, 125 ensure that this decrease in pressure is applied only to the breast (via the breast shield 7) and not the milk collection container 3. To measure the volume of milk collected in the container 3, the pump 83 is used instead to apply positive pressure to the diaphragm 13. The diaphragm 13 is forced to extend away from the pump 83 and conveys the pressure increase to the milk side 201 of the system 400. The three non-return valves 121, 123, 125 ensure that this increase in pressure is exclusively conveyed to the milk collection container 13.

The breast pump may further comprise: a first non-return valve between the milk flow side of the diaphragm and the breast shield, configured to allow only a negative pressure to be applied to the breast shield by the pump; a second non-return valve between the milk-flow side of the diaphragm and the milk collection container configured to allow only a positive pressure to be applied to the milk collection container by the pump; and a pressure sensor in pneumatic connection with the pressure-generation side of the diaphragm.

The resulting pressure increase is monitored behind the diaphragm 13 from the air-side 202 by a pressure sensor 101. Preferably, the pressure sensor 101 is a piezoelectric pressure sensor (piezo pressure sensor). The rate at which the pump 83 (at constant strength) is able to increase the pressure in the system 400 is a function of the volume of air that remains in the milk collection container 3. As air is many times more compressible than liquid, the rate at which pressure increases in the system 400 can be expressed as an approximate function of the volume of milk held in the collection container 3.

Thus by increasing the pressure in this fashion, the rate of pressure increase can be determined, from which the volume of milk held in the container 3 is calculable. Figure 13 shows repeated milking and volume measurement cycles as the collection container 3 is filled. To determine the rate of pressure increase the pump 83 was run for a fixed time. As pumping proceeds and the volume of air reduces in the system 400, the pump 83 is able to achieve a higher pressure. Each milking cycle is represented by a positive pressure spike 41. There is a clear upwards trend 43 in magnitude of positive pressures achieved as the collection container 3 is filled.

A method of estimating the pressure applied by a breast pump may comprise the steps of: selecting a pressure cycle from a pre-defined list of pressure cycles; applying pressure with the pump to stimulate milk expression; reading the output of the pressure sensor; and adjusting the applied pressure of the pump to match the pressure profile selected. This allows for repeatable application of force to the breast, even as the pump performance degrades.

Preferably the method further comprises the steps of: approximating the elasticity and extension of the diaphragm at the relevant pressure; and calculating an estimated applied pressure based upon the output of the pressure sensor and the approximated elasticity and extension of the diaphragm.

Alternatively, a method of estimating the milk collected by a breast pump may comprise the steps of: generating a positive pressure with the pump; transmitting the positive pressure via the diaphragm and second non-return valve to only the milk collection

container; measuring the increase in pressure by the pressure sensor in pneumatic connection with the diaphragm; estimating the volume of milk inside the milk collection container based upon the rate of increase of pressure. In this manner, the volume of milk can be estimated remotely.

In this manner, an estimate can be obtained for the volume of milk in the container 3 based upon the measured pressures.

Figure 13 also shows a dead end stop pump test 45 as described above. The negative spike shows the application of negative pressure directly to the pressure sensor 101.

2. Breast shield sizing and nipple alignment

The correct sizing of the breast shield and the alignment of the nipple in the breast shield are key for an efficient and comfortable use of the breast pump. However breast shape, size as well as nipple size and position on the breast vary from one person to another and one breast from another. In addition, women's bodies often change during the pumping life cycle and consequently breast shield sizing may also need to be changed. Therefore, a number of breast shield sizes are available. Guide lines for correct nipple alignment are also provided.

With reference to Figure 14, three breast shield sizes are shown (A1, B1, C1). The substantially clear breast shield gives an unobstructed view of the breast and allows a user to easily confirm that she has the appropriate sized shield for her breast.

In order to determine the correct breast shield size and nipple alignment, the breast shield and the diaphragm are detached from the housing and placed on the breast with the sizing symbol facing upwards (with the diaphragm positioned below the nipple) and the nipple aligned in the centre of the fit lines (as shown in A2, B2, C2). The transparent breast shield allows the user to observe the nipple while adjusting the position of the breast shield in order to align the nipple correctly near the centre of the breast shield nipple tunnel. Prior to using the pump, the nipple is aligned correctly, and the breast shield is pushed into place ensuring the seal is correctly positioned on the breast shield. The fit lines should be directly aligned with the outside of the nipple. The correct

alignment is illustrated B2.

When the nipple is correctly aligned, the user then rotates the breast shield in order for the diaphragm to be positioned on top of the nipple. The user may then quickly assemble the rest of the breast pump (i.e. the housing and the milk container) on the breast shield via a one-click attachment mechanism confirming correct engagement, which may be performed one-handed. Nipple alignment may therefore be easily maintained. Audio and/or haptic feedback may also be provided to further confirm correct engagement.

3. Connected Device Application

Figures 15 to 20 show examples of screenshots of a connected device application that may be used in conjunction with the breast pump system as described above. The interface shown here is an example only and the same data may be presented via any conceivable means including animated graphics, device notifications, audio or text descriptions.

Figure 15 shows a homepage of the application with different functions provided to the user which can be accessed either directly while pumping or at a later time in order for example: to review pump settings or the history of previous pumping sessions.

Figure 16 shows a status page with details of remaining battery life, pumping time elapsed and volume of milk inside the milk container.

Figure 17 shows screenshots of a control page, in which a user is able to control different pump parameters for a single breast pump (A) or two breast pumps (B). The user may press on the play button to either start, pause, or resume a pumping activity. The user may also directly increase or decrease the rate of expression using the (+) or (-) buttons. When only one breast is being pumped (A), the user may also indicate if it is either the right or left breast that is being pumped. The user may also control the pump peak pressure or alternatively may switch between different pre-programmed pressure profiles such as one mimicking the sucking pattern of a baby during expression or stimulation cycle.

Figure 18 shows a page providing a summary of the last recorded pumping session.

Figure 19 shows a page providing a history of previous pumping sessions. The user may scroll down through the page and visualize the data related to specific pumping sessions as a function of time.

The application is also capable of providing notifications relating to pumping. Figure 20 shows a screenshot of the application, in which a user is provided a notification when the milk collection bottle is full. Other generated notifications may include warnings about battery life, Bluetooth connection status or any other wireless communication status, status of miss-assembly, excessive movement or lack of expression.

Figure 21 shows a further example with a screenshot of an application running on a connected device. The page shows the pumping status when a user is using a double pump mode of operation with a pump on each breast. The user is able to manually control each pump individually and may start, stop or change a pumping cycle, increase or decrease each pump peak pressure, or switch between different pre-program pressure profiles such as one mimicking the sucking pattern of a baby during an expression or stimulation cycle. The application also notifies the user when a milk collection container is nearly full as shown in Figure 22.

Figure 23 shows a status page with an alert notifying the user that the milk collection container of the pump on the right breast is full. A message is displayed that the pump session has paused and that the milk collection container should be changed or emptied before resuming pumping.

With reference to Figure 24, when the left and right pump are stopped or paused, the application displays the elapsed time since the start of each session (right and left), the total volume of milk collected in each bottle.

With reference to Figure 25, a page summarising the last session (with a double pump mode) is displayed.

In addition to the data provided to the user, and their interactions with the application, the app will also hold data that the user does not interact with. For example, this may include data associated with pump diagnostics. In addition to all functions and sources of

data discussed above, the application may itself generate metadata associated with its use or inputs, notes or files uploaded by the user. All data handled within the mobile application can be periodically transferred to a cloud database for analysis. An alternative embodiment of the breast pump system may include direct contact between the database and the pump, so that pumping data may be conveyed directly, without the use of a smartphone application.

In addition to providing data to the cloud, the application may also provide a platform to receive data including for example firmware updates.

4. Breast pump data analysis

The discreet, wearable and fully integrated breast pump may offer live expression monitoring and intelligent feedback to the user in order to provide recommendations for improving pump efficiency or performance, user comfort or other pumping/sensing variables, and to enable the user to understand what variables correlate to good milk flow.

Examples of variables automatically collected by the device are: time of day, pump speed, pressure level setting, measured pressure, pressure cycle or duty cycle, voltage supplied to pumps, flow rate, volume of milk, tilt,, temperature, events such as when let-down happens, when a session is finished. The user can also input the following variables: what side they have pump with (left or right or both), and the comfort level.

This is in part possible because the live milk volume measurement system functions reliably (as discussed in Section B). The breast pump system includes a measurement sub system including IR sensors that measures or infers milk flow into the milk container, and that enables a data analysis system to determine patterns of usage in order to optimally control pumping parameters. The generated data may then be distributed to a connected device and/or to a cloud server for analysis in order to provide several useful functions.

Figure 26 illustrates an outline of a smart breast pump system network which includes the breast pump system (100) in communication with a peripheral mobile device and application (270) and several cloud-based databases (268, 273). The breast pump system

(100) includes several sensors (262). Sensor data refers to a broad definition including data generated from any sensor or any other analogue/digital reading directly from the motherboard or any other component. However, within the embodiment detailed, these measurements include one or more of the following, but not limited to: milk volume measurements, temperature sensor readings, skin temperature sensing, pressure sensor readings, accelerometer data and user inputs through any physical device interface.

The device also contains a number of actuators, including, but not restricted to: piezoelectric pump(s), solenoid valve(s), IREDs and an LED display. Sensors and actuators within the device are coordinated by the CPU (263). In addition, any interactions, and data from these components, may be stored in memory (264).

Further to these components, the device also contains a communication chip, such as a Bluetooth chip (265) which can be used to communicate wirelessly with connected devices such as a peripheral mobile device (270). Through this connection any sensor data (267) generated in the breast pump can be sent to the connected device. This user data, along with any other metadata generated from a connected device app, can be provided to an online database which aggregates all user data (273). In addition, the communication chip will also allow the sending of user control data / firmware updates from the connected device to the breast pump system (266).

Raw data (271) collected from the measurement sub-system including sensors (262) may be analysed on a cloud database and the analysed data may be stored on the cloud (272). Through inferences provided by the analysed data, firmware updates (269) may be developed. These can be provided for download to the pump through, for example, an online firmware repository or bundled with the companion app in the connected device app store (268).

In addition, it should be appreciated that despite the sophistication of the proposed breast pump network, the breast pump still retains complete functionality without wireless integration into this network. Relevant data may be stored in the device's memory (264) which may then be later uploaded to the peripheral portion of the system when a connection is established, the connection could be via USB cable or wireless.

The measurement sub-system may analyse one or more of the following:

- the quantity of the liquid in the container above its base;
- the height of the liquid in the container above its base;
- the angle the top surface of the liquid in the container makes with respect to a baseline, such as the horizontal.

Based on whether the quantity and/or the height of the liquid in the container above its base is increasing above a threshold rate of increase, a haptic and/or visual indicator indicates if the pump is operating correctly to pump milk. For example, the visual indicator is a row of LEDs that changes appearance as the quantity of liquid increases.

The visual indicator may provide:

- an estimation of the flow rate;
- an estimation of the fill rate;
- an indication of how much of the container has been filled.

As a further example, an accelerometer may infer the amount of movement or tilt angle during a pumping session. If the tilt angle excesses a threshold, the system warns or alerts the user of an imminent spillage, or provides the user with an alert to change position. Alternatively, the system may also stop pumping to prevent spillage, and once the tilt angle reduces below the threshold, pumping may resume automatically. By sensing the movement or title angle during a pumping session, the system may also derive the user's activity such as walking, standing or lying.

Many variables can affect milk expression and data analysis of these multiple variables can help mothers to achieve efficient pumping regimes and improve the overall user experience.

Therefore, the measurement sub-system measures or infers milk flow into the milk container and enables a user to understand what variables (e.g. time of day, pump setting) correlates to good milk flow. The amount of milk expressed over one or more sessions is recorded as well as additional metrics such as: time of day, pump setting, length of a single pumping session, vacuum level, cycle times, comfort, liquids consumed by the mother. Live data or feedback is then provided to the user to ensure the breast pump is

being used properly and to support the user in understanding the variables that would correspond to the specific individual optimum use of the breast pump.

Furthermore, live data can be used to automatically and intelligently affect specific pumping parameters in order to produce the most efficient pumping session. For example, if the rate of expression increases, the milking cycle might be adjusted accordingly to achieve a more efficient, or more comfortable pumping cycle.

The measurement sub-system also enables a data analysis system to determine patterns of usage in order to optimally control pumping parameters. Collected metrics are transferred through wireless connections between the pump, a connected device or app and a cloud database. Additionally, the application can also connect to other apps residing on the connected device, such as fitness app or social media app or any other apps. Further metrics may also include the behaviour or specific usage of the user associated with the connected device while using the pump (detection of vision and/or audio cues, internet usage, application usage, calls, text message).

Different aspects of pumping can be automatically changed based on dynamic sensor feedback within the breast pump device. The data analysis system is able to access real-time data of pumping sessions and may be used to perform one or more of the following functions, but not limited to:

- indicate whether the milk is flowing or not flowing,
- measure or infer the quantity and/or height of the liquid in the container above its base,
- give recommendations to the mother for optimal metrics for optimal milk flow,
- give recommendations to the mother for optimal metrics for weaning,
- give recommendations to the mother for optimal metrics for increasing milk supply (e.g. power pumping),
- give recommendations to the mother for optimal metrics if an optimal session start time or a complete session has been missed,
- automatically set metrics for the pumping mechanism, such as length of a single pumping session, vacuum level, cycle times.
- automatically stop pumping when the milk container is full,
- automatically adjust one or more pumping parameters to achieve an optimum

pumping session,

- automatically adjust one or more pumping parameters to achieve a comfortable pumping session,
- automatically change the pumping cycle from a programmed cycle to another different programmed cycle, such as from a stimulation cycle to an expression cycle.

In addition, sensor feedback might be used to improve the physical function of the breast pump system itself. For example, an array of piezoelectric pumps may be dynamically adjusted in response to their operating temperatures so as to optimise the total life of the component whist maintaining peak pressures.

Many additional embodiments may be described for these simple feedback systems, yet the premise remains: real-time sensor feedback is used to automatically and dynamically adjust actuator function. Each feedback program may feasibly include any number and combination of data sources and affect any arrangement of actuators.

The data generated can also be used to generate large datasets of pumping parameters, user metadata and associated expression rates, therefore allowing the analysis of trends and the construction of associations or correlations that can be used to improve pumping efficiency, efficacy or any function related to effective milk expression. The analysis of large user datasets may yield useful general associations between pumping parameters and expression data, which may be used to construct additional feedback systems to include on firmware updates.

Multiple data sources can be interpreted simultaneously and several different changes to pumping might be actuated to increase pumping efficiency, user experience or optimize pump performance.

Collected metrics may be anonymised and exported for sharing to other apps, community or social media platforms on the connected device, or to an external products and services, such as community or social media platform. By contrasting the performance of different users in the context of associated metadata, users may be grouped into discrete 'Pumper profiles' or communities, which may then be used to

recommend, or action the most appropriate selection of intelligent feedback systems to encourage efficient expression. For example, a higher peak pressure may be recommended for women who tend to move more whilst pumping, so as to achieve more efficient expression.

SECTION B: IR SYSTEM

This section describes the milk detecting system used in the Elvie™ pump.

With reference to Figures 27 and 28, there is shown a device 270 for use in detecting the level of liquid inside a container 275. The device 270 is formed of a housing 271 in which is located a sensing assembly 272 comprising a series of optical emitters 273 (an array of three optical emitters is used on one implementation) which are relative to, and each located at a distance from, an optical receiver 274. In operation of the device as will be described, each optical emitter 273 is operable to emit radiation which is received by the optical receiver 274. In an embodiment of the invention, the series of optical emitters are each located equidistant from the optical receiver 274.

The optical emitters 273 and the optical receiver 274 from the sensing assembly 272 are located in a portion 276 of the device 270 which faces the container 275 when the device is connected to the container 275. The portion 276 of the device 270 containing the optical emitters 273 and the optical receiver 274 comprises a window 277 of material which is transparent to optical radiation. In this way, each of the optical emitters 273 and the optical receiver 274 have a line of sight through the window 277 into the container 275 when the device 270 is connected thereto.

A controller 278 comprising a CPU 279 and a memory 280 is provided in the device 270 for controlling the operation of the sensing assembly 272. An accelerometer 281 is also provided in the housing 271, which is operatively connected to the controller 278. Operation of the device 270 when connected to the container 275 will now be described.

In a principal mode of operation, to determine the level L of liquid inside the container 275, the controller 278 instructs the optical emitters 273 to each emit radiation towards the surface of the liquid inside the container 275 at a given intensity. The optical receiver 274 receives the reflected radiation from each optical emitter 273 via the surface of the liquid and each of these intensities is recorded by the controller.

For each operation of the sensing assembly 272, the controller 278 records the intensities of radiation emitted by each of the optical emitters 273 as intensities IE1; IE2…IEn

(where n is the total number of optical emitters), and records the intensities of radiation received by the optical receiver 274 from each of the optical emitters 273 as received intensities IR1; IR2…IRn.

By comparing the emitted radiation intensities IE1; IE2…IEn with the received radiation intensities IR1; IR2…IRn, the controller 278 calculates a series of intensity ratios IE1:IR1; IE2:IR2…IEn:IRn, which are then used to determine the level of the liquid inside the container. At the most basic level, if the intensity ratio of IE1:IR1 is the same as IE2:IR2, given the optical emitters 273 are equidistant from the optical receiver 274, this indicates that the level of the liquid inside the container is parallel to the top of the bottle, as shown in Figure 27. In contrast, if these two intensity ratios are different, this indicates that the liquid level is at a different angle, such as that shown in Figure 28.

To accurately determine the level and the quantity of liquid inside the container 275, the controller 278 processes the recorded intensity ratios using a database located in the memory 280. The database contains an individual record for each container which is operable to connect with the device 270. Each record from the database contains a look-up table of information, which contains expected intensity ratios (IE1:IR1 and IE2:IR2) for the container 275 when filled at different orientations, and with different quantities of liquid.

By comparing the information from the look-up table with the recorded intensity ratios, the controller 278 calculates the level and quantity of liquid inside the container 275 and stores this information in the memory 280.

In situations where a container 275 to the device 270 contains no stored record in the database, the sensing assembly 272 can be used in a calibration mode to create a new record. In the calibration mode, the sensing assembly 272 is operated as the container is filled from empty, and as it is positioned at different orientations. At each point during the calibration mode, the controller 278 calculates the recorded intensity ratios (IE1:IR1 and IE2:IR2) and stores them in the record relating to the container 275. For each set of recorded intensity ratios, the user includes information in the record relating to the orientation and fill level of liquid inside of the container 275.

To improve the accuracy of the results obtained by the device 270 during its use, the controller 278 when recording each intensity ratio also records a parameter from the accelerometer 281 relating to the acceleration experienced by the device 270. For each recorded acceleration parameter, the controller 278 determines whether the parameter 278 exceeds a predetermined threshold acceleration parameter stored in the memory 280. The predetermined threshold is indicative of an excessive acceleration, which causes sloshing of liquid inside the container 275 connected to the device 270. In the event of a recorded acceleration parameter exceeding the predetermined threshold acceleration parameter, the controller 278 flags the recorded intensity ratios associated with the recorded acceleration parameter as being unreliable (due to sloshing).

Even without the use of the accelerometer 281, the controller 278 is nonetheless operable to determine whether a set of recorded intensity ratios occur during a period of excess acceleration. In this regard, for each set of intensity ratios recorded at a given time, the controller 278 checks whether any of these intensity ratios is of a predetermined order of magnitude different than the remaining recorded intensity ratios from the set. In the event that the controller 278 determines that this is the case, this indicates that the liquid inside the container has 'sloshed' as a result of the excess acceleration, as shown in Figure 29. In this event, the controller 278 flags the set of recorded intensity ratios as being unreliable.

It will be appreciated that instead of recording the relative intensities of radiation emitted by the optical emitters 273 with the radiation received by the optical emitter 274, the controller 278 could instead record the time taken for radiation emitted by each of the optical emitters 273 to be received by the optical receiver 274. In this arrangement, the look up table would instead contain time periods as opposed to intensity ratios.

In terms of the applications for the device 270, it will be appreciated that the device can be used in a wide variety of applications. One possible application is the use of the device 270 to determine the level of liquid located within a container 275, such as a baby bottle, used as part of a breast pump assembly. In this arrangement, the device 270 is associated with a breast pump 301 which assists with the expression of milk from a breast. The breast pump may be located in the housing 271 of the device 270 as shown in Figure 30, or it may be realisably connected to the housing 271.

Either way, the device 270 would be connectable to the container 275 such that milk expressed by the breast pump can pass from the pump via a channel 302 into the container 275.

The breast pump may be any type of breast pump system including any shapes of milk container or bottle and may comprise a pump module for pumping milk from a breast. The pump module being contained within the housing may comprise: a coupling, a container attachable to the housing via the coupling to receive milk from the pump, a sensing assembly within the housing and comprising at least one optical emitter operable to emit optical radiation towards the surface of the body of milk held in the container when the housing is connected to the container, an optical receiver for receiving the reflected radiation from the surface of the milk, and a controller electrically connected to the sensing assembly for receiving signals from the optical receiver and calculating the level of the milk inside the container based on the reflected radiation received by the optical receiver.

By determining the level of milk inside the container based on reflected radiation from the surface of the milk in the container, there is no need to monitor the individual droplets of milk entering the container, such that the sensing assembly can avoid errors associated with measuring these droplets. For example, because we take multiple reflection-based measurements once the container is filled, we can generate an average measurement that that is more accurate than a single measurement. But with systems that rely in counting individual droplets, that is not possible – further, systemic errors (e.g. not counting droplets below a certain size) will accumulate over time and render the overall results unreliable. Furthermore, by not needing to measure these droplets, the sensing assembly from the breast pump need not always be on during the pumping process, which saves power.

When at least two optical emitters are used, the sensing assembly from the breast pump may determine the level of milk inside the container more accurately and irrespective of the orientation of the liquid level inside the container.

Each optical emitter may be equidistant from the optical receiver in order for the

controller to easily calculate the level of the milk inside the container based on the reflected radiation originating from each optical emitter. The signals from the optical receiver preferably comprise information relating to the intensity of the radiation received by the optical receiver.

Each optical emitter may be operable to emit radiation at a different wavelength, or at a different time, than the other optical emitters. In this way, the controller can more easily process the signals from the optical receiver, and more easily distinguish between the radiation emitted by each of the optical emitters.

The optical emitter may emit radiation in the visible range of wavelengths. Alternatively, it may be UV or IR light. The emitted wavelength may be for example between 10nm and 1mm.

The sensing assembly may also comprise at least one accelerometer electrically connected to the controller. The controller may be configured to record an accelerometer parameter from the accelerometer and determine whether the accelerometer parameter exceeds a predetermined threshold. The predetermined threshold may be indicative of an excessive acceleration, which might cause sloshing of milk inside any container connected to the breast pump.

Another application for the device 270 is as a collar for detecting the level/quantity of liquid in a container 275, such as a baby bottle, via its lid 310. An example of the device 270 being used as such a collar is shown in Figure 31. In this arrangement, the device 270 is located between the container 275 and the lid 310, and comprises a first end 311 having a first coupling 312 for attaching the collar to the lid 310. The device comprises a second end 313 having a second coupling 314 for attaching the device 270 to the container 275. The second coupling may be a screw thread, shown in Figure 31, on the inside surface of the container 275. In this way, the distinctive bottom inside surface can be used by the sensing assembly 272 to more easily calibrate itself to the container 275 on which the distinctive bottom inside surface is located. The distinctive bottom may also be used to help identify which container 275 the device is connected to, and thus which record should be used from the database when the device 270 is used.

To further improve the accuracy of the sensing assembly 272, the controller 278 may also be configured to use the recorded information from the accelerometer 281, in situations where the record acceleration is below the predetermined threshold acceleration parameter, to calculate a more accurate liquid level and/or quantity of liquid located inside the container which is compensated for acceleration.

In one particular arrangement, the controller 278 may poll the accelerometer 281 prior to each operation of the sensing assembly 272 to verify that the device 270 is not currently undergoing excessive acceleration. In the event of the controller 278 determining excessive acceleration in the device 270, the controller 278 would continually re-poll the accelerometer, and not operate the sensing assembly 272, until the parameter from the accelerometer is determined as being below the predetermined threshold acceleration parameter stored in the memory 280.

It will also be appreciated that for each container record stored in the database, the container record may comprise a plurality of look up tables, wherein each look up table is associated with a particular liquid used in the container, and wherein each look up table contains its own set of intensity ratios. In this way, the device 270 can more accurately determine the level/quantity of different liquids used in a particular container 275.

As described herein, the sensing assembly 272 has been described as having a plurality of optical emitters 273. It will be appreciated however that the sensing assembly could operate using a single optical emitter 273 and plurality of optical receivers 274. In this arrangement, each record from the database would contain a plurality of ratios relating to the emitted radiation from the optical emitter 273 as received by each of the optical receivers 274. In use of the device 270, the controller 278 would then similarly record the emitted radiation from the optical emitter 273 as received by each of the optical receivers 274. In an alternate arrangement, there may be provided a plurality of optical emitters 273 and a plurality of optical receivers 274, wherein each optical emitter 273 is associated with a respective optical receiver 274. In its simplest arrangement, the sensing assembly 272 may comprise a single optical emitter 273 and a single optical receiver 274.

In certain configurations, the optical emitters 273 may together emit radiation having the same wavelength. In other configurations, the optical emitters 273 may each emit

radiation having a different wavelength. In this latter configuration, the optical receiver 274 would then be able to determine which optical emitter 273 is associated with any given received radiation, based on the wavelength of the received radiation.

The optical emitters 273 may also each emit radiation at different times, such to allow the controller 278 to more easily process the signals from the optical receiver 274, and more easily distinguish between the radiation emitted by each of the optical emitters 273.

In relation to the electrical connection between the controller 278 and the sensing assembly 272, it will be appreciated this electrical connection may be either a wired/wireless connection as required.

Although not shown in the Figures, the device 270 herein described is preferably powered by a battery or some other power source located in the device 270. In other embodiments, the device 270 may be powered using mains electricity.

In one configuration, it is also envisaged that rather than the controller 278 comparing the information from the look-up table with the recorded intensity ratios to calculate the level and quantity of liquid inside the container 275, the controller 278 could instead process the recorded intensity ratios through a liquid-level equation stored in the memory 280. In this configuration, the liquid-level equation could be a generalised equation covering a family of different containers, or could be an equation specific to a container having a given shape and/or type of liquid inside.

It will also be appreciated that in some applications of the device 270, the device could be used to detect the level of a solid, as opposed to a liquid, in a container. As used herein, the terms ‘optical emitter’ and ‘optical receiver’ are intended to cover sensors which can emit radiation in or close to the optical wavelength. Any type of radiation at or close to the optical wavelength is suitable provided that it does not have any harmful effects. The exact wavelength is not important in the context of the invention. Such sensors thus include those which can emit visible radiation (such as radiation having wavelengths in the region of 400nm-700nm), and/or those which can emit IR radiation (such as radiation having wavelengths in the region of 700nm-1mm and/or those which can emit UV radiation (such as radiation having wavelengths in the region of 10nm to

400nm).

Existing prior art for such a sensor module is the apparatus disclosed in RU2441367. In this apparatus, the container is an industrially sized milk tank, which only includes a single laser mounted at the top of the tank. Whilst this apparatus is suited for large-sized containers, which do not move in use, the apparatus is less-suited for applications where the container moves in use, or where the liquid level inside the container is non perpendicular to the laser beam shone into the container. In contrast, the sensor module described above can be used in a variety of different applications, is conveniently located within a housing, and which by virtue of it having at least two optical emitters, can determine the level of liquid even inside containers of irregular shapes, and which can determine the level of liquid inside a container irrespective of the orientation of the liquid level inside the container.

Further to the embodiments of the fluid measurement system in different contexts, it can be appreciated that different functions entirely may be possible using the same component structure. For example, it is known that certain molecules within breast milk absorb specific wavelengths of light at characteristic propensities. Whilst the proposed system uses multiplexed IREDs at the same wavelengths to perform proximity measurements, the same array of IREDs may instead be used to emit several different wavelengths of light and determine their absorption upon reflection. If appropriately calibrated, the system may be able to report on the presence or concentration of specific compounds in the expressed milk, such as fat, lactose or protein content.

In addition to this embodiment, it is feasible that the system might be applied to monitor the change in volume of any other container of liquid, given there is sufficient reflection of IR off its surface. These embodiments might include for example: liquid vessel measurement such as for protein shakes, cement or paint, or volume measurements within a sealed beer keg.

SECTION C: BRA CLIP

This section describes a bra clip that forms an accessory to the Elvie™ pump.

It relates to a system allowing a user to quickly and simply adjust the cup size of a maternity bra to allow discrete and comfortable insertion and use of an integrated wearable breast pump. As such, the user does not need a specialised adjustable bra; instead the present system works with all conventional maternity bras. The user also does not have to purchase any larger bras to wear while pumping.

As shown in Figure 32, a typical maternity bra 320 comprises a support structure made up of shoulder straps 321 which support the bra 320 on the wearer's shoulders, and a bra band 322 for extending around a user's ribcage, comprising two wings 323 and a central panel or bridge 324. The straps 321 are typically provided with adjustment mechanisms 325 for varying the length of the straps 321 to fit the bra 320 to the wearer. At the outermost end of each wing, an attachment region 326 is provided. Typically, hooks 327 and loops 328 are provided for securing the bra 320 at the user's back. However, any other suitable attachment mechanism may be used. Alternatively, the attachment region 326 may be provided at the front of the bra 320 in the bridge region 324, with a continuous wing 323 extending continuously around the wearer's back. Typically, a number of sets of loops 328 are provided to allow for variation in the tightness of the bra 320 on the wearer. While shown as having a separation in Figure 32, the wings 323 and bridge 324 may form a single continuous piece in certain designs. Likewise, while shown with a distinct separation in Figure 32, the shoulder straps 321 and the wings 323 may likewise form a single continuous piece.

The maternity bra 320 is further provided with two breast-supporting cups 329 attached to the support structure. The cups 329 define a cup size, which defines the difference in protrusion of the cups 329 from the band 322. The European standard EN 13402 for Cup Sizing defines cup sizes based upon the bust girth and the underbust girth of the wearer and ranges from AA to Z, with each letter increment denoting a 2 cm difference between the protrusion of the cups 329 from the band 322. Some manufacturers do vary from these conventions in denomination, and some maternity bras are measured in sizes

of S, M, L, XL, etc.

The cups 329 may be stitched to the bra band 321. At least one of the cups 329, is in detachable attachment with the corresponding strap 321. In particular, this is achieved at attachment point 330 where a hook 331 attached to the bra strap 321 engages with a clasp 331 attached to the cup 329. The hook 331 and the bra strap adjuster 325 are set such that in the closed position, the cup size of the bra 320 fits the wearer's breasts.

In Figure 32, the left cup 329 is shown attached to its attachment point 330, which the right cup 329 is unattached. In this manner, the wearer is able to detach the cup 329 to expose their breast for feeding or for breast pumping. Once this is completed, the cup 329 is reattached and the maternity bra 320 continues to function as a normal bra.

While in the depicted embodiments, a hook 331 is shown on the bra strap 321 and a clasp 332 is shown on the cup 329, it is appreciated that the provision of these may be reversed, or that alternative attachment mechanisms may be used.

A maternity bra therefore may comprise a support structure comprising shoulder straps and a bra band and a first and a second cup each attached to the support structure to provide a first cup size, at least one cup being at least partially detachable from the support structure at an attachment point.

In other embodiments, the detachable attachment point 330 may be provided at a different location, such as at the attachment between the bra band 322 and the cup 329. The mechanism for such an attachment point is the same as described above.

A clip has been designed such that it is configured to be attached to the support structure at a position away from the attachment point. This results in the original attachment point being usable, with the clip providing an alternative attachment point to give, in effect, an adjusted cup size.

Alternatively, the clip may also be attachable to the support structure at a plurality of non-discrete positions. This ensures essentially infinite adjustment of the clip position such that the perfect position for the user can be found.

The clip can also extend between an unextended and an extended state, and can attach to the support structure at the attachment point; the first cup size is providable when the at least partially detachable cup is attached to the clip when the clip is an unextended state; the second cup size is providable when the at least partially detachable cup is attached to the clip when the clip is in an extended state. An extendable clip like this allows quick switching between the two states in use.

Figure 33 depict a clip 335 according to the present invention, along with a clasp 332 shown in isolation from the bra cup 329 it is normally attached to. The clip comprises a first engagement mechanism and at least one second engagement mechanism(s). The clip is attachable in a releasable manner to the support structure at a first position via the first engagement mechanism and attachable in a releasable manner to one of the partially detachable cups via the second engagement mechanism to provide a second cup size different to the first cup size. The clip 335 is provided with a material pathway 336 which receives a portion of the bra strap 321. In the particular embodiment of these Figures, the clip 335 is substantially U-shaped, with a narrowing profile towards its open end. However, it is appreciated that any other suitable shape with a material pathway may be used, such as an S-shape or E-shape. The clip 335 is designed to be attached to the bra strap 321 in a releasable manner, with the slot 336 acting as a support engaging mechanism. The releasable manner means that the clip 335 may be simply removed from the bra 320 without causing any damage to the functioning of the bra 320. To enhance the ease of attachment, the clip 335 may be provided with outwardly extending wings 204 which help direct the bra strap 321 into the clip 335. The clip 335 is further provided with a hook 220 acting as a cup engaging mechanism which can engage with the clasp 332.

Figure 33 (c) shows the clip 335 being attached to a bra strap 321 in order to provide a second attachment point 337 for the clasp 332 to attach to, and hence to provide a second cup size for the bra 320. In this particular embodiment, the clip 335 is attached in a portion of strap 321A below the original attachment point 330 and hence the second attachment point 337 is likewise below the original attachment point. This results in a second cup size larger than the first cup size. In preferred embodiments, as shown in these Figures, the clip 335 engages with the support structure in a direction transverse to

the direction in which it engages with the cup.

Figure 33 (d) and (e) show how a wearer is able to move between the first and second cup sizes. In 33(d), the cup 329 is attached at the first attachment point 330 to provide a first cup size. The wearer then disengages the clasp 332 from the hook 331 at the hook 338 at the second engagement point 239. In this manner, the wearer is easily able to transition between the two cup sizes.

Figures 34 and 35 show an alternative design for a clip 340. This clip 340 is substantially “E-shaped”, with a back portion 341 and first, second and 5 third prongs 342A, 342B, 342C extending transverse from this back portion 341. The three prongs 342A, 342B, 342C are spaced apart along the length of the back portion 341. The first and third prongs 342A, 342C are provided with attachment clips 343A, 343B.

These attachment clips 343A, 343B can engage with the clasp 332 of a bra to provide the second cup size. Depending upon the orientation of the clip 300, one or the other of the attachment clips 343A, 343B will be used to attach the clasp 332 of the bra. By providing these clips 343A, 343B on both of the first and the third prongs 342A, 342C the clip is easily reversible so it can be used on either side of the bra. Preferably the clip 340 is also symmetrical, to aid the reversibility of the clip 340.

Figure 35 shows the clip 340 attached to a bra. As can be seen, the first and third prongs 342A, 342C extend on the front side of the bra strap, with the second prong 342B extending on the rear side of the bra strap. In this manner, the clip 340 is attached to the strap. In preferable embodiments, a grip-enhancing member 344 such as a number of projections and/or roughened patches can be provided on the second prong 342B in order to strengthen this grip.

In alternative embodiments, the attachment clip could be provided on the second, centremost prong 342B. In such an arrangement, the centremost prong 342B would be on the outside of the bra, with the first and third prongs 342A, 342C on the inside.

The provision of the attachable clip allows maternity bras already owned by the wearer to be quickly transformed into bras with quick switchable double cup size options.

This allows the use of integrated wearable breast pumps which increase the user's required cup size. This allows more design freedom for the breast pump in terms of size and shape, while still allowing the user to discretely pump with the pump held within their bra. By allowing conversion of the user's existing maternity bras, they are not forced to purchase specially designed bras to wear with the pump. The bra is hence normally at the first engagement point 330 when the breast pump device is not being used. As shown in Figure 33, the clasp 332 is then engaged by the user to discretely switch between the two configurations, and the user then inserts the pump without any complex adjustment or removal of clothing.

Preferably, the clip will be relatively unobtrusive in size and shape and hence can be left in place when the bra is first put on and used when necessary. To this end, the clip is preferably machine washable without significant damage or degradation.

In some embodiments, the clip may be switchable between positions for engaging with each cup so that a single clip may be used on either side of the bra. To achieve this, the clip is preferably reversible. This may provide the user with a visual indication of which breast has produced milk most recently so switching can take place.

In a preferred embodiment, the first engagement mechanism engages with the support structure in a first direction and the second engagement mechanism engages with the cup in a second direction transverse to the first direction. This increases ease of attachment as with this structure the sideways engagement of the clip to the support structure ensures that the second attachment mechanism is correctly orientated for the cup.

The second engagement mechanism may be one or more of a hook or a snap or a clip. This ensures easy interfacing with the traditional hook and clasp systems already provided on maternity bras.

Preferably the clip further comprises two distinct second engagement mechanisms which can be used interchangeably dependent upon the orientation of the clip. This makes the clip easier to use as it can be quickly switched between each bra strap, and the user does not have to worry which way up to put the clip on.

Preferably, the clip comprises a material pathway with an opening for receiving a portion of the support structure as the first engagement mechanism for securing the clip to the bra. This ensures a quick and simple method for attaching the clip to the bra. In particular, the clip may substantially U-shaped, and the material pathway is between the arms of the U.

Preferably, the clip comprises three prongs extending from a central support, the three prongs arranged as a central prong and two outer prongs so as to receive the support structure on one side of the central prong and on the opposite side of each respective outer prong, at least one prong being provided with the second engagement mechanism. This ensures a strong attachment to the bra and a simple design.

Preferably, both outer prongs are each provided with a respective second engagement mechanism. This ensures that the clip is reversible for easier attachment to the bra.

A method of adjusting the cup size of a maternity bra is provided according to the present invention, comprising: providing a maternity bra comprising: a support structure comprising shoulder straps and a bra band; and a first and second cup each attached to the support structure to provide a first cup size, the at least one cup being detachable from the support structure at an attachment point, providing a clip comprising first and section engagement mechanisms, attaching the first engagement mechanism of the clip in a releasable manner to a first position of the support structure of the maternity bra, attaching one of the detachable cup to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size.

This clip and method allow a user to quickly and simply adjust the cup size of a maternity bra to allow discrete and comfortable insertion and use of an integrated wearable breast pump.

Preferably, the method further comprises the step of inserting a breast pump into the detachable cup. The adjustment of the size of the bra allows the bra to support the breast pump against the user's breast for comfort and ease.

Preferably, the method further comprises the steps of: detaching the first engagement mechanism of the clip from the first position support structure of the maternity bra; attaching the first engagement mechanism of the clip in a releasable manner to a second position of the support structure of the maternity bra; and attaching the other of the detachable cups to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size. This allows the user to use a single clip on either of the cups.

An alternative embodiment may be provided, with an extendable clip 360 as shown in Figure 36. In such an embodiment the clip is attached to the hook 331 on the strap 321 in a releasable manner, with the clasp 332 attached to an expandable portion of the clip. The clip is then able to expand between an unexpanded state where the clasp 332 is held in substantially the same position as the first attachment point 330 to provide the first cup size, and an expanded state, where the clasp 332 is held in a second position away from the first attachment point 330 to provide the second cup size.

For example, an elongate clip with first and second opposite ends may be provided. A first attachment point for attaching to the hook 331 is provided at the first end, and a second attachment point for attaching to the clasp 332 is provided at the second end. The elongate clip is hinged between the two ends, such that the clip can be folded between an elongate configuration to a closed configuration where the second end touches the first end. A clasp can be provided on the clip to hold the second end in this closed configuration. Thus, in the closed position the clasp 332 is held in substantially the same location as the first attachment point 330 to provide the first cup size, and in the open position the clasp is held away from the first attachment point 330 to provide the second cup size.

Other extendable clip embodiments are also possible, for example sliding clips or elastic clips.

Additional embodiments of a maternity bra adjuster are provided in Figures 37 and 38. The alternative proposed solution is a small adapter device, which comprises a first portion 370 including a clasp 373 and a second portion 372 including a hook 374, in which the first and second portions are separated by a small distance 371 in order to

provide two different adjustable sizes. The first portion includes a clasp 373 that is designed to attach to the hook on the bra strap 321. It may also include a top hook 375 positioned underneath the clasp, and a clip 376 on the rear side. The second portion includes a bottom hook 372.

The clasp 332 that is present on the cup 329 of the maternity bra, may then either engage with the top hook (321) to provide a first cup size, and engage with the bottom hook (332) to provide a second cup size that is different from the first cup size, as illustrated in Figure 39. The user may then discretely switch between a non pumping position, provided by the first cup size, and a second pumping position without any complex adjustment or removal of clothing needed, while using a wearable breast pump system (100).

The first portion and second portion may be made of plastic and may be separated by a stretchy material such as elastic or elastomeric material. The first portion may also include a clip on the rear side, the purpose of which is to allow the user to leave the clip attached to the bra for an extended time period.

Section D: Use of Piezo Pump in Wearables

As described in Section A, the breast pump system includes a piezo air pump, resulting in a fully wearable system that delivers a quiet, comfortable and discreet operation in normal use. This section gives further information on the piezo air pump.

In comparison with other pumps of comparable strength, piezo pumps are smaller, lighter and quieter.

Each individual Piezo pump weighs approximately 6gm and may, with material and design improvements, weigh less than 6gm.

In operation, the Elvie breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise; tests indicate that it makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.

Piezo pumps also have lower current draw, allowing for increased battery life. A piezo pump is therefore ideally suited for wearable devices with its low noise, high strength and compact size. Further, as shown in the breast pump system of Figures 7 and 8, more than one piezo pump may be used.

Whilst a breast pump system is largely described in previous sections, the use of piezo mounted either in series or in parallel can also be implemented in any medical wearable devices or any wearable device. The piezo pump may pump air as well as any liquid.

With reference to Figure 40, a diagram illustrating a configuration of two piezo pumps mounted in series is shown.

With reference to Figure 41, a diagram illustrating a configuration of two piezo pumps mounted in parallel is shown.

With reference to Figure 42, the air pressure generated as a function of time by two piezo pumps mounted in series and two piezo pumps mounted in parallel are compared. In

this example, the parallel configuration produces higher flow rate and achieves -100mmHg negative air pressure faster than the series configuration. In comparison, the series configuration produces lower flow rate and takes slightly longer to reach 100mmHg. However, the parallel configuration cannot achieve as high as a vacuum as the series configuration and plateaus at -140mmHg. In comparison, the series configuration is able to generate about -240mmHg.

A dual configuration is also implemented in which more than one piezo pump is configured such that they can easily switch between a parallel mode and a series mode. This dual configuration would suit wearable devices that would need to achieve either lower or higher pressure faster.

Figure 43 shows a plot of the air pressure generated as a function of time by two piezo pumps mounted in a dual configuration. In this dual configuration, the piezo pumps first start with a parallel mode in order to benefit from faster flow rate, and then switch to a series mode (as indicated by the switch-over point) when stronger vacuums are required, enabling to save up to 500ms on cycle time with elastic loads.

Additionally, a piezo pump may be used in combination with a heat sink in order to efficiently manage the heat produced by the wearable pump. This configuration may be used to ensure that the wearable device can be worn comfortably. The heat sink or heat sinks are configured to ensure that the maximum temperature of any parts of the breast pump system that might come into contact with the skin (especially prolonged contact for greater than 1 minute) are no more than 48°C and preferably no more than 43°C.

The heat sink may store the heat produced by a piezo pump in order to help diverting the heat produced to another location. This not only ensures that the wearable system can be worn comfortably, but also increases the lifetime of a piezo pump.

Figure 44 shows a picture of a wearable breast pump housing including multiple piezo pumps (440). The breast pump system is wearable and the housing is shaped at least in part to fit inside a bra. By applying a voltage to the piezo pumps, the pressure provided by the pumps increase. The generation of higher pressure by the piezo pumps also means higher heat produced that needs to be managed. Each piezo pump is therefore

connected to a heat sink (441), such as a thin sheet of copper. The heat sink has a long thermal path length that diverts the heat away from the piezo pump.

The use of a heat sink in combination with a piezo pump is particularly relevant when the wearable device is worn directly or near the body, and where the management of heat induced by the piezo pump is crucial.

A wearable device including a piezo pump may therefore include a thermal cut out, and may allow for excess heat to be diverted to a specific location. The heat sink may be connected to an air exhaust so that air warmed by the piezo pumps vents to the atmosphere. For example, the wearable system is a breast pump system and the heat sink stores heat, which can then be diverted to warm the breast shield of the breast pump system.

Use cases application include but are not limited to:

- Wound therapy;
- High degree burns;
- Sleep apnoea;
- Deep vein thrombosis;
- Sports injury.

APPENDIX: SUMMARY OF KEY FEATURES

In this section, we summarise the various features implemented in the Elvie™ pump system. We organize these features into six broad categories:

A. Elvie Breast Pump: General Usability Feature Cluster

B. Elvie Piezo Air Pump Feature Cluster

C. Elvie Milk Container Feature Cluster

D. Elvie IR System Feature Cluster

E. Elvie Bra Clip Feature Cluster

F. Other Features, outside the breast pump context

Drilling down, we now list the features for each category:

A. Elvie Breast Pump: General Usability Feature Cluster

Feature 1 Elvie is wearable and includes only two parts that are removable from the pump main housing in normal use.

Feature 2 Elvie is wearable and includes a clear breast shield giving an unobstructed view of the breast for easy nipple alignment.

Feature 3 Elvie is wearable and includes a clear breast shield with nipple guides for easy breast shield sizing.

Feature 4 Elvie is wearable and includes a breast shield that audibly attaches to the housing.

Feature 5 Elvie is wearable and includes a breast shield that attaches to the housing with a single push.

Feature 6 Elvie is wearable and not top heavy, to ensure comfort and reliable suction against the breast.

Feature 7 Elvie is wearable and has a Night Mode for convenience.

Feature 8 Elvie is wearable and includes a haptic or visual indicator showing when milk is flowing or not flowing well.

Feature 9 Elvie is wearable and collects data to enable the mother to understand what variables (e.g. time of day, pump speed etc.) correlate to good milk-flow.

Feature 10 Elvie is wearable and collects data that can be exported to social media.

Feature 11 Elvie is wearable and has a smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh.

Feature 12 A smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh.

Feature 13 Elvie is wearable and includes a sensor to infer the amount of movement or tilt angle during normal use.

Feature 14 Elvie includes a control to toggle between expressing milk from the left breast and the right breast.

Feature 15 Elvie includes a pressure sensor.

Feature 16 Elvie includes a microcontroller to enable fine tuning between pre-set pressure profiles.

Feature 17 Elvie enables a user to set the comfort level they are experiencing.

Feature 18 Elvie includes a microcontroller to dynamically and automatically alter pump operational parameters.

Feature 19 Elvie automatically learns the optimal conditions for let-down.

B. Elvie Piezo Air Pump Feature Cluster

Feature 20 Elvie is wearable and has a piezo air-pump for quiet operation.

Feature 21 Elvie has a piezo air-pump and self-sealing diaphragm

Feature 22 Elvie uses more than one piezo air pump in series.

Feature 23 Elvie is wearable and has a piezo air-pump, a breast shield and a diaphragm that fits directly onto the breast shield.

Feature 24 Elvie is wearable and has a piezo air-pump for quiet operation and a re-useable, rigid milk container for convenience.

Feature 25 Elvie has a piezo-pump for quiet operation and is a connected device.

Feature 26 Elvie uses a piezo in combination with a heat sink that manages the heat produced by the pump.

Feature 27 Elvie is wearable and gently massages a mother's breast using small bladders inflated by air from its negative pressure air-pump.

Feature 28 Elvie is wearable and gently warms a mother's breast using small chambers inflated by warm air from its negative pressure air-pump.

C. Elvie Milk Container Feature Cluster

Feature 29 Elvie is wearable and includes a re-useable, rigid milk container that forms the lower part of the pump, to fit inside a bra comfortably.

Feature 30 Elvie is wearable and includes a milk container that latches to the housing with a simple push to latch action.

Feature 31 Elvie is wearable and includes a removable milk container with an integral milk pouring spout for convenience.

Feature 32 Elvie is wearable and includes a removable milk container below the milk flow path defined by a breast shield for fast and reliable milk collection.

Feature 33 Elvie is wearable and includes a breast shield and removable milk container of optically clear, dishwasher safe plastic for ease of use and cleaning.

Feature 34 Elvie is wearable and includes various components that self-seal under negative air pressure, for convenience of assembly and disassembly.

Feature 35 Elvie is wearable and includes a spout at the front edge of the milk container for easy pouring.

Feature 36 Elvie is wearable and includes a milk container that is shaped with broad shoulders and that can be adapted as a drinking bottle that baby can easily hold.

D. Elvie IR System Feature Cluster

Feature 37 Elvie is wearable and includes a light-based system that measures the quantity of milk in the container for fast and reliable feedback.

Feature 38 The separate IR puck for liquid quantity measurement.

Feature 39 The separate IR puck combined with liquid tilt angle measurement.

E. Bra Clip Feature

Feature 40 Bra Adjuster.

F. Other Features that can sit outside the breast pump context

Feature 41 Wearable device using more than one piezo pump connected in series or in parallel.

Feature 42 Wearable medical device using a piezo pump and a heat sink attached together.

We define these features in terms of the device; methods or process steps which correspond to these features or implement the functional requirements of a feature are also covered.

We'll now explore each feature 1 – 42 in depth. Note that each feature can be combined with any other feature; any sub-features described as 'optional' can be combined with any other feature or sub-feature.

A. Elvie Breast Pump: General Usability Feature Cluster

Feature 1 Elvie is wearable and includes only two parts that are removable from the pump main housing in normal use

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) a breast shield;

(c) a rigid or non-collapsible milk container;

and in which the breast pump system includes only two parts that are directly removable from the housing in normal use or normal dis-assembly: the breast shield and the rigid, non-collapsible milk container.

Optional:

- The only parts of the system that come into contact with milk in normal use are the breast shield and the milk container.
- Milk only flows through the breast shield and then directly into the milk container.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The two removable parts are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and nipple tunnel shaped to receive a nipple.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings, in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- No other parts are removable from the breast shield, apart from the flexible diaphragm.
- The milk container attaches to a lower surface of the housing and forms the base of the breast pump system in use.
- The milk container mechanically or magnetically latches to the housing.
- The milk container is released by the user pressing a button on the housing.
- The milk container includes a removable cap and a removable valve that is seated on the lid.
- In normal use, the milk container is positioned entirely within a bra.

- No other parts are removable from the milk container, apart from the cap and the valve.
- All parts that are user-removable in normal use are attached to either the breast shield or the milk container.
- Audible or haptic feedback confirms the pump system is properly assembled for normal use with the milk container locked to the housing and the breast shield locked to the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 2 Elvie is wearable and includes a clear breast shield giving an unobstructed view of the breast for easy nipple alignment

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield including a substantially transparent nipple tunnel, shaped to receive a nipple, providing to the mother placing the breast shield onto her breast a clear and unobstructed view of the nipple when positioned inside the nipple tunnel, to facilitate correct nipple alignment.

Optional:

- The breast shield is configured to provide to the mother a clear and unobstructed view of the nipple when the breast shield is completely out, of or separated from, the housing.
- The breast shield is configured to provide to the mother a clear and unobstructed view of the nipple when the breast shield is partially out of, or partially separated from, the housing.
- Entire breast shield is substantially transparent.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- A milk container attaches to a lower surface of the housing and forms the base of the breast pump system in use.
- The milk container mechanically or magnetically latches to the housing.
- The milk container is released by the user pressing a button on the housing.

- The milk container includes a removable cap and a removable valve that is seated on the lid.
- In normal use, the milk container is positioned entirely within a bra.

Feature 3 Elvie is wearable and includes a clear breast shield with nipple guides for easy breast shield sizing

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield including a substantially transparent nipple tunnel shaped to receive a nipple, the nipple tunnel including guide lines that define the correct spacing of the nipple from the side walls of the nipple tunnel.

Optional:

- The guide lines run generally parallel to the sides of the nipple placed within the nipple tunnel.
- Breast shield is selected by the user from a set of different sizes of breast shield to give the correct spacing.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around the nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers in the housing locate into small indents in the breast shield.

- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 4 Elvie is wearable and includes a breast shield that audibly attaches to the housing.

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield that is attachable to the housing with a mechanism that latches with an audible click when the breast shield is slid on to or against the housing with sufficient force.

Optional:

- The breast shield is configured to slide onto or against the housing in a direction parallel to the long dimension of a nipple tunnel in the breast shield.

- Breast shield is removable from the housing with an audible click when the breast shield is pulled away from the housing with sufficient force.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around the nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- The edge of the flexible diaphragm seals, self-seals, self-energising seals, or interference fit seals against the housing when the breast shield attaches to the housing.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.

- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 5 Elvie is wearable and includes a breast shield that attaches to the housing with a single push

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield configured to attach to the housing with a single, sliding push action.

Optional:

- The breast shield is configured to slide onto or against the housing in a direction parallel to the long dimension of a nipple tunnel in the breast shield.
- The single push action overcomes a latching resistance.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into a nipple tunnel in the breast shield to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield when the breast shield has been placed onto a breast using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b)

transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.

- The edge of the flexible diaphragm seals, self-seals, self-energising seals, or interference fit seals against the housing when the breast shield attaches to the housing.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- A milk container attaches to a lower surface of the housing and forms the base of the breast pump system in use.
- The milk container mechanically or magnetically latches to the housing.
- The milk container is released by the user pressing a button on the housing.
- The milk container includes a removable cap and a removable valve that is seated on the lid.
- In normal use, the milk container is positioned entirely within a bra.

Feature 6 Elvie is wearable and not top heavy, to ensure comfort and reliable suction against the breast

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism

(b) and a breast shield;

(c) a milk container;

and in which the centre of gravity of the pump system is, when the milk container is empty, substantially at or below (i) the half-way height line of the housing or (ii) the horizontal line that passes through a nipple tunnel or filling point on a breast shield, so that the device is not top-heavy for a woman using the pump.

Optional:

- The milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- In which the centre of gravity only moves lower during use as the milk container gradually receives milk, which increases the stability of the pump inside the bra.
- In which milk only passes downwards when moving to the milk container, passing through the nipple tunnel and then through an opening in the lower surface of the nipple tunnel directly into the milk container, or components that are attached to the milk container.
- System is configured so that its centre of gravity is no more than 60mm up from the base of the milk container also below the top of the user's bra cup.
- In which the pumping mechanism and the power supply for that mechanism are positioned within the housing to provide a sufficiently low centre of gravity.
- In which the pumping mechanism is one or more piezo air pumps, and the low weight of the piezo air pumps enables the centre of gravity to be substantially at or below (i) the half-way height line of the housing or (ii) the horizontal line that passes through the nipple tunnel or filling point on the breast shield.
- In which the pumping mechanism is one or more piezo air pumps, and the small size of the piezo air pumps enables the components in the housing to be arranged so that the centre of gravity is substantially at or below (i) the half-way height line of the housing or (ii) the horizontal line that passes through the nipple tunnel or filling point on the breast shield.
- In which the pumping mechanism is one or more piezo air pumps, and the low weight of the battery or batteries needed to power that piezo air pumps enables the centre of gravity to be substantially at or below (i) the half-way height line of

the housing or (ii) the horizontal line that passes through the nipple tunnel or filling point on the breast shield.

- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 7 Elvie is wearable and has a Night Mode for convenience

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) an illuminated control panel;

(c) a control system that reduces or adjusts the level or colour of illumination of the control panel at night or when stipulated by the user.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Control system is implemented in hardware in the pump itself using a 'night mode' button.
- Control system is implemented in software within a connected device app running on the user's smartphone.
- Control system is linked to the illumination level on a connected device app., so that when the connected app is in 'night mode', the illuminated control panel is also in 'night mode', with a lower level of illumination, and when the illuminated control panel on the housing is in 'night mode', then the connected app is also in 'night mode'.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast. The pumping mechanism is one or more piezo air pumps, selected for quiet operation.

Feature 8 Elvie is wearable and includes a haptic or visual indicator showing when milk is flowing or not flowing well

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) a milk container that is configured to be concealed within a bra and is hence not visible to the mother in normal use;

(c) a visual and/or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

Optional:

- A haptic and/or visual indicator indicates if the pump is operating correctly to pump milk, based on whether the quantity and/or the height of the liquid in the container above its base is increasing above a threshold rate of increase
- The visual indicator is a row of LEDs that changes appearance as the quantity of liquid increases.
- The haptic and/or visual indicator provides an indication of an estimation of the flow rate.
- The visual indicator provides a colour-coded indication of an estimation of the flow rate.
- The visual indicator provides an indication of how much of the container has been filled.
- The visual indicator is part of a user interface in a connected, companion application, running on a smartphone or other personal device, such as a smart watch or smart ring.
- The haptic indicator is part of a user interface in a connected, companion application, running on a smartphone or other personal device, such as a smart watch or smart ring.
- A sub-system measures or infers the quantity and/or the height of the liquid in the container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect

light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.

- Sub-system includes or communicates with an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- A sub-system measures or infers the angle the top surface of the liquid in the container makes with respect to a baseline, such as the horizontal.
- A haptic and/or visual indicator indicates if the amount of milk in the milk container has reached a preset quantity or level.
- A haptic and/or visual indicator indicates if there is too much movement of the breast pump system for viable operation.
- Milk container is attached to the lower part of the housing and forms the base of the breast pump system.
- Milk container is made of transparent material.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 9 Elvie is wearable and collects data to enable the mother to understand what variables (e.g. time of day, pump speed etc.) correlate to good milk-flow

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) a milk container;

(c) a measurement sub-system that measures or infers milk flow into the milk container;

and in which the measurement sub-system provides data to a data analysis system that determines metrics that correlate with user-defined requirements for milk-flow rate or milk expression.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- User-defined requirement is to enhance or increase milk-flow.
- User-defined requirement is to reduce milk-flow.
- The data analysis system analyses data such as any of the following: amount of milk expressed over one or more sessions, rate at which milk is expressed over one or more sessions, profile of the rate at which milk is expressed over one or more sessions.
- The data analysis system determines metrics such as any of the following: pump speed, length of a single pumping session, negative air pressure or vacuum level, peak negative air pressure or vacuum level, pump cycle time or frequency, changing profile of pump speed over a single pumping session time of day.
- The data analysis system determines metrics such as any of the following: amount and type of liquids consumed by the mother, state of relaxation of the mother before or during a session, state of quiet experienced by the mother before or during a session, what overall milk expression profile the mother most closely matches.
- Data analysis system is local to the breast pump system, or runs on a connected device, such as a smartphone, or is on a remote server or is on the cloud, or is any combination of these.
- measurement sub-system measures or infers the quantity and/or the height of the liquid in the container above its base.
- Measurement sub-system measures or infers angle the top surface of the liquid in the container makes with respect to a baseline, such as the horizontal.
- Data analysis system gives recommended metrics for improving milk flow
- Data analysis system gives recommended metrics for weaning.
- Data analysis system gives recommended metrics for increasing milk supply (e.g. power pumping).
- Data analysis system gives recommended metrics if an optimal session start time or a complete session has been missed.

- Data analysis system leads to automatic setting of metrics for the pumping mechanism, such as pump speed, length of a single pumping session, vacuum level, cycle times, changing profile of pump speed over a single pumping session.
- Data analysis system enables sharing across large numbers of connected devices or apps information that in turn optimizes the milk pumping or milk weaning efficacy of the breast pump.
- Metrics include the specific usage of the connected device by a woman while using the pump (for example by the detection of vision and/or audio cues).
- The measurement sub-system measures or infers the quantity and/or the height of the liquid in the container.
- The measurement sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.
- The measurement sub-system includes or communicates with an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the measurement sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- Milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 10 Elvie is wearable and collects data that can be exported to social media.

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) a milk container;

(c) a data sub-system that collects and provides data to a connected device or remote application or remote server;

(d) and in which the collected data, in whole or in part, is used by a data analysis system that provides inputs to a social media or community function or platform.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- The data analysis system analyses metrics such as any of the following: amount of milk expressed over one or more sessions, rate at which milk is expressed over one or more sessions, profile of the rate at which milk is expressed over one or more sessions.
- The data analysis system analyses metrics such as any of the following: pump speed, length of a single pumping session, negative air pressure or vacuum level, peak negative air pressure or vacuum level, pump cycle time or frequency, changing profile of pump speed over a single pumping session time of day.
- The data analysis system analyses metrics such as any of the following: amount and type of liquids consumed by the mother, state of relaxation of the mother before or during a session, state of quiet experienced by the mother before or during a session, what overall milk expression profile the mother most closely matches.
- Data analysis system is local to the breast pump system, or runs on a connected device, such as a smartphone, or is on a remote server or is on the cloud, or is any combination of these.
- The social media or community function or platform organizes the collected data into different profiles.
- The social media or community function or platform enables a user to select a matching profile from a set of potential profiles.
- each profile is associated with a specific kind of milk expression profile, and provides information or advice that is specifically relevant to each milk expression profile.
- Information or advice includes advice on how to increase milk expression by varying parameters, such as time of milk expression, frequency of a milk

expression session, pump speed, length of a single pumping session, vacuum level, cycle times, changing profile of pump speed over a single pumping session and any other parameter that can be varied by a mother to help her achieve her milk expression goals.

- The application is connected to other applications residing on the connected device, such as a fitness app.
- The collected data includes data received from other connected apps.
- The collected data is anonymised before it is shared.
- The sub-system includes a wi-fi connectivity component for direct connectivity to a remote server.
- The milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 11 Elvie is wearable and has a smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh

A breast pump system including a pumping mechanism and a milk container and including:

(a) a housing including the pumping mechanism;

(b) a milk container;

(c) and in which the milk container or any associated part, such as a lid, includes a memory or tag that is automatically programmed to store the time and/or date it was filled with milk.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Memory or tag is programmed to store the quantity of milk in the milk container.
- Memory or tag stores the milk expiry date.

- Memory or tag stores a record of the temperature of the milk or the ambient temperature around the milk, and calculates an expiry date using that temperature record.
- System includes a clock and writes the time and/or date the milk container was filled with milk to the memory or tag on the milk container.
- Clock is in the housing.
- Clock is in the milk container.
- Milk container includes a display that shows the time and/or date it was filled with milk.
- Milk container includes a display that shows the quantity of milk that it was last filled with milk.
- Milk container includes a display that shows whether the left or right breast was used to fill the milk container.
- Memory or tag is connected to a data communications sub-system.
- Memory or tag is a remotely readable memory or tag, such as a NFC tag, enabling a user to scan the milk container with a reader device, such as a smartphone, and have the time and/or date that container was filled with milk, displayed on the reader device.
- Reader device shows the time and/or date a specific milk container was filled with milk.
- Reader device shows the quantity of milk that a specific milk container was last filled with.
- Reader device shows the time and/or date and/or quantity that each of several different milk containers were filled with.
- Reader device shows whether the left or right breast was used to fill the milk contained in a specific milk container.
- A sub-system measures or infers milk flow into the milk container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.

- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/Tr the height of the liquid in the container.
- The sub-system is in the housing.
- Milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 12 A smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh.

A smart bottle or container that includes or is associated with a memory or a tag that is programmed to store the date and time it is filled using data from a pump or a connected device, such as a smartphone.

Optional:

- The container includes wireless connectivity and connects to a companion app.
- The memory or tag includes an NFC chip and is read using a NFC reader.
- The memory or tag stores also an expiry date.
- Memory or tag stores a record of the temperature of the milk or the ambient temperature around the milk, and calculates an expiry date using that temperature record.
- The memory or tag stores also the quantity of milk stored.
- System includes a clock and writes the time and/or date the milk container was filled with milk to the memory or tag on the milk container.
- Clock is in the housing.
- Clock is in the container.
- Milk container includes a display that shows the time and/or date it was filled with milk.
- Milk container includes a display that shows the quantity of milk that it was last filled with milk.

- Milk container includes a display that shows whether the left or right breast was used to fill the milk contained.
- Milk container includes a display that shows the expiry date.
- memory or tag is connected to a data communications sub-system.
- Memory or tag is a remotely readable memory or tag, such as a NFC tag, enabling a user to scan the milk container with a reader device, such as a smartphone.
- Reader device shows the time and/or date a specific milk container was filled with milk.
- Reader device shows the quantity of milk that a specific milk container was last filled with.
- Reader device shows the time and/or date and/or quantity that each of several different containers were filled with.
- Reader device shows whether the left or right breast was used to fill the milk contained in a specific milk container.
- Reader device shows the expiry date.
- Container includes wireless connectivity and connects to a companion application.
- An application tracks status of one or more smart containers and enables a user to select an appropriate smart container for a feeding session.
- The pump is wearable.
- The pump is in a housing shaped to fit inside a bra and the container is a milk container that is connected to the housing and is positioned to form the base of the housing.
- Container is used for liquids other than milk.

Feature 13 Elvie is wearable and includes a sensor to infer the amount of movement or tilt angle during normal use.

A breast pump system including:

(a) a housing;

(b) a milk container;

(c) the housing including a sensor, such as an accelerometer, that measures or determines the movement and/or tilt angle of the housing, during a pumping session and automatically affects or adjusts the operation of the system depending on the output of the sensor.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- If the tilt angle of the housing exceeds a threshold, then the system automatically affects the operation of the system by warning or alerting the mother of a potential imminent spillage (e.g. from milk flowing back out of a breast shield) using an audio, or visual or haptic alert, or a combination of audio, haptic and visual alerts.
- If the tilt angle of the housing exceeds a threshold, then the system automatically adjusts the operation of the system by stopping the pump to prevent spillage.
- When the tilt angle of the housing reduces below the threshold, the system automatically adjusts the operation of the system by causing pumping to resume automatically.
- If the tilt angle of the housing exceeds a threshold, then the system automatically affects the operation of the system by providing the mother with an alert to change position.
- The container includes an optically clear region.
- There are one or more light emitters and detectors positioned in the base of the housing, the light emitters and receivers operating as part of a sub-system that measures or infers the tilt angle of the milk in the container.
- The sub-system measures the quantity of liquid in the milk container and also takes the measured tilt angle of the housing into account.
- If the tilt angle is above a certain threshold, the system ignores the quantity of liquid measured.
- The sub-system derives or infers the mother's activity, such as walking, standing or lying activities, from the sensor.
- The milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.

- Sub-system stores a time-stamped record of movement and/or tilt angles of the housing in association with milk flow data.
- System includes a breast shield that attaches to the housing.
- System includes a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 14 Elvie includes a control to toggle between recording whether milk is being expressed from the left breast and the right breast.

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a control interface that the user can select to indicate or record if milk is being expressed from the left or the right breast.

Optional:

- Control interface is a physical interface on the housing.
- Control interface is a single button on the housing.
- Control interface is from an application running on a device, such as a smartphone or smart ring.
- Visual indicators on the housing indicate whether the breast pump system is being set up the left or the right breast.
- The visual indicator for the left breast is on the right-hand side of the housing, when viewed from the front; and the visual indicator for the right breast is on the left-hand side of the housing, when viewed from the front.
- The housing includes a button labeled to indicate the left breast and a button labeled to indicate the right breast, that are respectively illuminated to indicate from which breast the milk is being expressed.
- Breast pump system is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 15 Elvie includes a pressure sensor.

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) an air pressure sensor configured to measure the negative pressure delivered by the negative air-pressure mechanism and (iii) a measurement sub-system that measures or infers milk flow or milk volume.

Optional:

- The system also includes a control sub-system that combines or relates the air-pressure measurements with the milk flow or milk volume measurements
- The control sub-system automatically adjusts the negative air-pressure to give the optimal milk flow or milk volume.
- The control sub-system automatically adjusts the negative air-pressure during a pumping session to give the optimal milk flow or milk volume within comfort constraints defined by the user.
- The air pressure sensor detects pressure created by the pumping mechanism.
- Sensor is a piezo air pressure sensor
- Air pressure sensor measures the negative air pressure during a normal milk expression session.
- Air pressure sensor measures the negative air pressure during a calibration session, and the system uses the results to vary the operation of the pumping mechanism so that it deliver consistent performance over time.
- Air pressure sensor measures the negative air pressure during a calibration session, and the system uses the results to vary the operation of the pumping mechanism so that different pumping mechanisms in different breast pump systems all deliver consistent performance
- Air pressure sensor measures the negative air pressure during a calibration session, and the system uses the results to determine if the pumping mechanism is working correctly, within tolerance levels.
- The operation of the pumping mechanism is varied by altering the duty or pump cycle.
- The operation of the pumping mechanism is varied by altering the voltage applied to the pumping mechanism.
- Pumping mechanism is a piezo air pump.

- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 16 Elvie includes a microcontroller to enable fine tuning between pre-set pressure profiles

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to cause the pumping mechanism to deliver various pre-set pressure profiles and to permit the user to manually vary the pressure to a value or values that are in-between the values available from a pre-set pressure profile.

Optional:

- The user manually varies the pressure using a control interface on a housing of the breast pump system
- The user manually varies the pressure using a control interface on an application running on a wireless device such as a smartphone that is wirelessly connected to the breast pump system.
- The user manually varies the pressure by altering a control parameter of the pumping mechanism.
- The user manually varies the pressure by altering the duty cycle or timing of the

pumping mechanism.

- The user manually varies the pressure by altering the voltage applied to the pumping mechanism.
- The system includes an air pressure sensor configured to measure the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.
- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Pressure profile defines one or more maximum negative air pressure levels.
- Pressure profile defines one or more maximum negative air pressure levels, each for a pre-set time.
- Pressure profile defines one or more cycle time.
- Pressure profile defines peak flow rate.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 17 Elvie enables a user to set the comfort level they are experiencing

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to control the pumping mechanism and to permit the user to manually indicate the level of comfort that they are experiencing when the system is in use.

Optional:

- The user manually indicates the level of comfort that they are experiencing using a touch or voice-based interface on a housing of the breast pump system
- The user manually indicate the level of comfort that they are experiencing using a touch or voice-based interface on an application running on a wireless device, such as a smartphone, that is wirelessly connected to the breast pump system.
- The system stores user-indicated comfort levels together with associated parameters of the pumping system.
- The system is a connected device and a remote server stores user-indicated comfort levels together with associated parameters of the pumping system.
- The parameters of the pumping system include one or more of: pumping strength, peak negative air pressure; flow rate; voltage applied to the pumping mechanism; duty or timing cycle of the pumping mechanism.
- System automatically varies parameters of the pumping system and then enables the user to indicate which parameters are acceptable.
- System includes an air pressure sensor that measures the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.
- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the

intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 18 Elvie includes a microcontroller to dynamically and automatically alter pump operational parameters

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to automatically change one or more parameters of the pumping mechanism, and to automatically measure or relate milk expression data as a function of different values of one or more of these parameters.

Optional:

- The milk expression data includes one or more of the following: milk expression rate or quantity; comfort; optimal pumping mode; optimal pumping mode given remaining battery power.
- The system automatically calculates or identifies the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity and uses that set of parameters.
- The system automatically calculates or identifies the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity and uses that set of parameters if the comfort experienced by the user when those parameters are used is above a threshold.
- The system displays the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity to the user.
- The system displays the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity to the user and enables the user to manually select those parameters if they are acceptable.
- Parameters of the pumping mechanism includes pumping strength, peak negative air pressure; flow rate; voltage applied to the pumping mechanism; duty or timing cycle of the pumping mechanism.
- System includes an air pressure sensor that measures the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.

- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 19 Elvie automatically learns the optimal conditions for let-down

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to dynamically change one or more parameters of the pumping mechanism, and to automatically detect the start of milk let-down.

Optional:

- The microcontroller is programmed to dynamically change one or more parameters of the pumping mechanism, to enable it to learn or optimize the parameters relating to milk let-down.
- The system automatically calculates or identifies or learns the parameters of the pumping mechanism that correlate with the quickest start of milk let-down.
- The system automatically calculates or identifies or learns the parameters of the pumping mechanism that correlate with the quickest start of milk let-down and uses that set of parameters if the comfort experienced by the user when those

parameters are used is above a threshold or are otherwise acceptable to the user.

- The system displays the parameters of the pumping mechanism that correlate with the quickest start of milk let-down to the user.
- The system displays the parameters of the pumping mechanism that correlate with the quickest start of milk let-down and enables the user to manually select those parameters if they are acceptable.
- parameters of the pumping mechanism includes pumping strength, peak negative air pressure; flow rate; voltage applied to the pumping mechanism; duty or timing cycle of the pumping mechanism.
- System includes an air pressure sensor that measures the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.
- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

B. Elvie Piezo Air Pump Feature Cluster

Feature 20 Elvie is wearable and has a piezo air-pump for quiet operation

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a piezo air-pump in the housing that is part of a closed loop system that drives, a separate, deformable diaphragm to generate negative air pressure.

Optional:

- The deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The closed system is separated from a 'milk' side by a flexible diaphragm.
- Deformable diaphragm is removably mounted against a part of a breast shield.
- Deformable diaphragm is a unitary or one-piece object that is removably mounted against a part of a breast shield.
- Deformable diaphragm is not physically connected to the piezo air-pump.
- Piezo air-pump is a closed loop air-pump that drives a physically separate and remote deformable diaphragm that removably fits directly onto the breast shield
- Deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.

- The piezo pump is fed by air that passes through an air filter.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 21 Elvie has a piezo air-pump and self-sealing diaphragm

A breast pump system including:

(a) a housing;

(b) a piezo air-pump in the housing that is part of a closed loop system that drives, a physically separate, deformable, self-sealing diaphragm, to generate negative air pressure.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement .
- The closed system is separated from a 'milk' side by the flexible diaphragm.
- Deformable diaphragm is removably mounted against a part of a breast shield.
- Deformable diaphragm is a unitary or one-piece object that is removably mounted against a part of a breast shield.
- Deformable diaphragm is not physically connected to the piezo air-pump.
- Piezo air-pump is a closed loop air-pump that drives a physically separate and remote deformable diaphragm that removably fits directly onto the breast shield.
- Deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing,

and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.

- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- The piezo pump is fed by air that passes through an air filter.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 22 Elvie uses more than one piezo air pump in series

A breast pump system including:

(a) a housing;

(b) multiple piezo air-pumps in the housing that drives a deformable diaphragm inside the housing to generate negative air pressure; in which the multiple piezo air-pumps can be operated at different times in series-connected and in parallel-connected modes.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Parallel connected mode is used during a first part of a pumping cycle to reach a defined negative air pressure more quickly than series connected mode would, and then the system switches to a series connected mode to reach a greater negative air pressure than series connected mode can reach.
- An actuator switches the system from parallel-connected piezo pump mode to series-connected piezo pump mode.

- Each piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- Each piezo air pump weighs less than 10 gm, and may weigh less than 6gm..
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- Each piezo pump is fed by air that passes through an air filter.
- Each piezo air pump forms part of a closed or closed loop system.
- Each piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- The piezo-air pumps are a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.

Feature 23 Elvie is wearable and has a piezo air-pump, a breast shield and a diaphragm that fits directly onto the breast shield

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a breast shield that attaches to the housing;

(b) a piezo air-pump in the housing that drives a deformable diaphragm that fits directly onto the breast shield.

Optional:

- Deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Deformable diaphragm is removable from the diaphragm housing for cleaning.

- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- Piezo air pump is position at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum. power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.The piezo pump is fed by air that passes through an air filter.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The breast shield and milk container are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.

Feature 24 Elvie is wearable and has a piezo air-pump for quiet operation and a re-useable, rigid milk container for convenience

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a piezo air-pump in the housing;

(c) and a re-useable, rigid or non-collapsible milk container that when connected to the housing forms an integral part of the housing and that is also removable from the housing.

Optional:

- Piezo air pump forms part of a closed or closed loop system.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The closed system is separated from a 'milk' side by a flexible diaphragm.

- A deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- The deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- The deformable diaphragm is removable from the diaphragm housing for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel in the breast shield includes an opening on its lower surface that is positioned through which expressed milk flows directly into the milk container.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.

Feature 25 Elvie has a piezo-pump for quiet operation and is a connected device

A breast pump system including

(a) a housing;

(b) a piezo air-pump in the housing;

(c) a milk container;

(d) a data connectivity module that enables data collection relating to the operation of the piezo air-pump and transmission of that data to a data analysis system.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Transmission is to an application running on a connected device such as a smartphone, or a server, or the cloud.
- The data collection and transmission relates to any other operational data of the system.
- Piezo air pump forms part of a closed or closed loop system.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- The closed system is separated from a 'milk' side by a flexible diaphragm.
- A deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.

- The deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Deformable diaphragm is removable from the diaphragm housing for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel in the breast shield includes an opening on its lower surface that is positioned through which expressed milk flows directly into the milk container.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- A sub-system measures or infers the quantity and/or the height of the liquid in the container and shares that data with the data connectivity module.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.
- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- The data analysis system analyses metrics such as any of the following: amount of milk expressed over one or more sessions, rate at which milk is expressed over one or more sessions, profile of the rate at which milk is expressed over one or more sessions.
- The data analysis system analyses metrics such as any of the following: pump speed, length of a single pumping session, negative air pressure or vacuum level,

peak negative air pressure or vacuum level, pump cycle time or frequency, changing profile of pump speed over a single pumping session time of day.

- The data analysis system analyses metrics such as any of the following: amount and type of liquids consumed by the mother, state of relaxation of the mother before or during a session, state of quiet experienced by the mother before or during a session, what overall milk expression profile the mother most closely matches.

Feature 26 Elvie uses a piezo in combination with a heat sink that manages the heat produced by the pump.

A breast pump system including:

(a) a housing;

(b) a piezo air-pump in the housing that drives a deformable diaphragm inside the housing to generate negative air pressure;

(c) a heat sink to manage the heat produced by the piezo-air pump to ensure it can be worn comfortably.

Optional:

- The heat sink is configured to ensure that the maximum temperature of any parts of the breast pump system that might come into contact with the skin, especially prolonged contact for greater than 1 minute, are no more than 48°C and preferably no more than 43°C.
- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Heat sink is connected to an air exhaust so that air warmed by the piezo pumps vents to the atmosphere.
- Heat sink warms a breast shield.
- Piezo air pump forms part of a closed or closed loop system.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.

- There are two or more piezo air pumps, each connected to its own or a shared heat sink.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- The closed system is separated from a 'milk' side by a flexible diaphragm.
- A deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.
- The deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- The deformable diaphragm is removable from the diaphragm housing for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel in the breast shield includes an opening on its lower surface that is positioned through which expressed milk flows directly into the milk container.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.

Feature 27 Elvie is wearable and gently massages a mother's breast using small bladders inflated by air from its negative pressure air-pump

A breast pump system including:

(a) a housing;

(b) an air-pump in the housing that drives a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast;

(c) in which the air pump also provides air to regularly or sequentially inflate one or more air bladders or liners that are configured to massage one or more parts of the breast.

Optional:

- Air-pump is a piezo pump.
- Breast pump system is wearable and the housing is shaped at least in part to fit inside a bra.
- Bladders or liners are formed in a breast shield that attaches to the housing.

Feature 28 Elvie is wearable and gently warms a mother's breast using small chambers inflated by warm air from its negative pressure air-pump

A breast pump system including:

(a) a housing;

(b) an air-pump, such as a piezo pump, in the housing that drive a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast;

(c) in which the air pump also provides warm air to regularly or sequentially inflate one or more air chambers that are configured to apply warmth to one or more parts of the breast.

Optional:

- Breast pump system is wearable and the housing is shaped at least in part to fit inside a bra.
- The air chamber is a deformable diaphragm positioned on a breast shield that attaches to the housing.

C. Elvie Milk Container Feature Cluster

Feature 29 Elvie is wearable and includes a re-useable, rigid milk container that forms the lower part of the pump, to fit inside a bra comfortably

A wearable breast pump system configured including:

(a) a housing shaped at least in part with a curved surface to fit inside a bra and including a pumping mechanism;

(b) and a re-useable rigid or non-collapsible milk container that when connected to the housing forms an integral, lower part of the housing, with a surface shaped to continue the curved shape of the housing, so that the pump system can be held comfortably inside the bra.

Optional:

- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is attached to the housing with a push action.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture, spout or lid that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a

breast shield, and milk flows under gravity through the opening into the milk container.

- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump mechanism to ensure that negative air-pressure is not applied to the milk container.
- The pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 30 Elvie is wearable and includes a milk container that latches to the housing with a simple push to latch action

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a milk container that is attachable to the housing with a mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.

Optional:

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- Milk container, when connected to the housing, forms an integral, lower part of the housing and that is removable from the housing with a release mechanism that can be operated with one hand.

- Mechanism that releasably attaches or latches is a mechanical or magnetic mechanism.
- Mechanical mechanism includes flanges on the top of the milk container, or the sealing plate that seals the opening to the milk contained, that engage with and move past a surface to occupy a latched position over that surface when the milk container is pressed against the housing to lock into the housing.
- The housing includes a button that when pressed releases the milk container from the housing by flexing the surface away from the flanges so that the flanges no longer engage with and latch against the surface.
- Mechanism that attaches or latches the milk container into position does so with an audible click.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing by releasing the latch and moving the housing off the milk container.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container.
- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container.

- The pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 31 Elvie is wearable and includes a removable milk container with an integral milk pouring spout for convenience

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a re-useable milk container that is connected to the housing with a surface shaped to continue the curved or breast-like shape of the pump, so that the pump can be held comfortably inside a bra and where the milk container includes a pouring spout for pouring milk.

Optional:

- Spout is integral to the milk container.
- Spout is integral to a removable lid to the milk container.
- Spout is positioned at or close to the front edge of the milk container.
- Spout is removable from the container, such as by clipping off the container.
- A teat is attachable to the spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.

- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container through the pouring spout in the milk container.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- The pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 32 Elvie is wearable and includes a removable milk container below the milk flow path defined by a breast shield for fast and reliable milk collection

A wearable breast pump system including:

(a) a housing including a pumping mechanism, the housing being shaped at least in part to fit inside a bra;

(b) and a breast shield including a nipple tunnel shaped to receive a nipple, and including an opening that defines the start of a milk flow path;

(c) a re-useable milk container that when connected to the housing is positioned entirely below the opening or the milk flow path, when the breast pump is positioned or oriented for normal use.

Optional:

- The milk container includes an aperture that sits directly underneath the opening in the nipple tunnel in the breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container through the pouring spout in the milk container.
- Milk flows from the opening directly into the milk container.
- Milk flows from the opening directly into the milk container.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against the opening in the breast shield, and milk flows under gravity through the opening into the milk container.
- Milk flows from the opening directly onto a valve that is attached to the milk container, the valve closing whilst there is sufficient negative air pressure in the volume of air between the valve and the breast shield opening, and then opening to release the milk into the container when the air pressure rises sufficiently.
- Milk flows from the opening directly onto a valve that is attached to a spout, that is in turn attached to the milk container.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- A flexible rubber or elastomeric valve is mounted onto the milk container cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container, and milk flows towards and is retained by the duck bill valve whilst the valve is closed, and flows past the valve into the milk container when the negative air pressure is released and the valve opens.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The two removable parts are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.

- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.

Feature 33 Elvie is wearable and includes a breast shield and removable milk container of optically clear, dishwasher safe plastic for ease of use and cleaning

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) and a breast shield defining a region shaped to receive a nipple, the region defining the start of a milk flow path;

(c) a re-useable, rigid or non-collapsible milk container that when connected to the housing is positioned to form the base of the housing;

and in which the breast shield and the milk container are made substantially of an optically clear, dishwasher safe material.

Optional:

- The material is a polycarbonate material, such as Tritan™.

- breast pump system is wearable and the housing is shaped at least in part to fit inside a bra.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield operates with a flexible diaphragm that flexes when negative air pressure is applied to it by an air pump system in the housing, and transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The breast shield and milk container are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.

Feature 34 Elvie is wearable and includes various components that self-seal under negative air pressure, for convenience of assembly and disassembly

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including an air pumping mechanism;

(b) a breast shield;

(c) a diaphragm that flexes in response to changes in air pressure caused by the air pumping mechanism and that seals to the breast shield;

(d) a re-useable milk container that seals to the breast shield;

and in which either or both of the diaphragm and the re-useable milk container substantially self-seal under the negative air pressure provided by the pumping mechanism.

Optional:

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a

breast shield, and milk flows under gravity through the opening into the milk container.

- The re-useable milk container includes a 1 way valve that self-seals against a conduit from the breast shield and allows milk to pass into the container but not spill out, and in which the valve (a) closes and (b) partly or wholly self-seals against the conduit under the negative air pressure provided by the pumping mechanism.
- The 1 way valve is attached to the milk container, or a lid or spout of the milk container with an interference fit and is readily removed in normal use for separate cleaning.
- The diaphragm partly or wholly self-seals to the breast shield under the negative air pressure provided by the pumping mechanism.
- The diaphragm partly or wholly self-seals to the housing under the negative air pressure provided by the pumping mechanism.
- The diaphragm is attached to the diaphragm housing using elastomeric or rubber latches and is readily removed in normal use for separate cleaning.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The breast shield and milk container are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.

- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.

Feature 35 Elvie is wearable and includes a spout at the front edge of the milk container for easy pouring

A wearable breast pump system configured as a single unit and including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a milk container that forms an integral part of the housing;

(c) a re-useable pouring spout that is positioned at or close to the front edge of the milk container.

Optional:

- Milk container is a multifunctional bottle, operating as both a storage container to contain milk that is being expressed, as well as a refrigeratable and freezable storage bottle for that milk, as well as a bottle from which that milk can be drunk by a baby.
- Spout is integral to a removable lid to the milk container.
- Spout is removable from the container, such as by clipping off the container.
- A teat is attachable to the spout.
- By placing the spout at or close to the front edge of the milk container, the milk container fully empties more readily than where the spout is placed in the middle of the lid of a milk container.
- The spout sits generally under an opening in the breast shield spout or nipple tunnel through which expressed milk flows.
- The re-useable milk container includes a 1 way valve that self-seals against a conduit from the breast shield and allows milk to pass into the container but not spill out, and in which the valve (a) closes and (b) partly or wholly self-seals against the conduit under the negative air pressure provided by the pumping mechanism.

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.

Feature 36 Elvie is wearable and includes a milk container that is shaped with broad shoulders and that can be adapted as a drinking bottle that baby can easily hold

A wearable breast pump system configured as a single unit and including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) a breast shield;

(c) a milk container that is removable from the housing and is shaped or configured to also serve as a drinking bottle that is readily held by a baby because it is wider than it is tall.

Optional:

- Teat is attachable directly to the milk container.
- Pouring or drinking spout is integral to the milk container.
- The shoulders are at least 2cm in width, and the neck is no more than 1 cm in height, to enable a baby to readily grip and hold the container when feeding from the milk in the container.
- Spout/teat/straw resides near the edge of the container's rim.
- Milk container is a multifunctional bottle, operating as both a storage container to contain milk that is being expressed, as well as a refrigertable and freezable storage bottle for that milk, as well as a bottle from which that milk can be drunk by a baby.
- The re-useable milk container includes a 1 way valve that self-seals against a conduit from the breast shield and allows milk to pass into the container but not spill out, and in which the valve (a) closes and (b) partly or wholly self-seals

against the conduit under the negative air pressure provided by the pumping mechanism.

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- Spout is integral to the milk container.
- Spout is integral to a removable lid to the milk container.
- Spout is positioned at or close to the front edge of the milk container.
- Spout is removable from the container, such as by clipping off the container.
- A teat is attachable to the spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container through the pouring spout in the milk container.
- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.

D. Elvie IR System Feature Cluster

Feature 37 Elvie is wearable and includes a light-based system that measures the quantity of milk in the container for fast and reliable feedback

A system for milk volume determination, for use as part of a breast pump, or breast milk collecting device, including:

(a) a re-useable rigid or non-collapsible milk container;

(b) at least one light emitter, configured to direct radiation towards the surface of the milk;

(c) at least one light detector, configured to detect reflected radiation from the surface of the milk;

wherein the light emitters and detectors operate as part of a sub-system that measures the height of, or infers the quantity of, the milk in the container.

Optional:

The wearable breast pump system includes:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield;

(c) a re-useable rigid or non-collapsible milk container that when connected to the housing is positioned to form the base of the housing;

and in which the top of the container includes an optically clear region that is aligned below one or more light emitters positioned in the base of the housing.

- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.
- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.

- The sub-system measures or infers the quantity and/or the height of the liquid in the container and shares that data with a data connectivity module.
- Where the quantity or level exceeds a threshold, then the pumping mechanism automatically changes mode, e.g. from a stimulation mode to an expression mode.
- Where the quantity or level exceeds a threshold, then the pumping mechanism automatically stops.
- Milk-flow data is captured and stored.
- If milk-flow falls below a threshold, then a notification is provided to the mother.

Feature 38 The separate IR puck for liquid quantity measurement

A liquid-level measuring system for measuring the quantity of liquid in a container for a breast pump; the system including:

(a) one or more light emitters directing light at the surface of the liquid in the container;

(b) one or more light receivers configured to detect light from the light emitters that has been reflected from the liquid;

(c) a sub-system that infers, measures or calculates the quantity in the liquid using measured properties of the detected light;

(d) a collar or other fixing system that positions the system over the container.

Optional:

- The quantity of milk is measured as milk enters the container or as milk is removed from the container.
- Measured property includes the reflected light intensity

Feature 39 The separate IR puck combined with liquid tilt angle measurement

A liquid-level measuring system for measuring the tilt angle of liquid in a container; the system including:

(a) one or more light emitters directing light at the surface of the liquid in the container;

(b) one or more light receivers configured to measure properties of the light reflected from the liquid;

(c) a sub-system including an accelerometer that infers, measures or calculates the tilt angle of the liquid using measured properties of the detected light;

(d) a collar or other fixing system that positions the system over the container.

Optional:

- Measured property includes the reflected light intensity
- The quantity of liquid is measured as liquid enters the container or as liquid is removed from the container.
- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container and shares that data with a data connectivity module.

Generally applicable optional features

- Weight of the entire unit, unfilled, is under 250g and preferably 214g.
- Silver based bactericide is used on all parts that are not steam or heat sterilized in normal cleaning.
- Housing includes a rechargeable battery.
- System is self-contained.
- System is a closed loop system.
- Breast pump system is a self-contained, wearable device that includes an integral rechargeable battery, control electronics, and one or more air pumps operating as a closed system, driving a flexible diaphragm that in turn delivers negative air-pressure to the breast, to cause milk to be expressed.
- Housing has a generally rounded or convex front surface and has a generally tear-drop shape when seen from the front.

E. Bra Clip Feature Cluster

Feature 40 Bra Adjuster

A bra adjuster for a nursing or maternity bra, the nursing or maternity bra including a bra cup with a flap that can be undone to expose the nipple, and the flap attaching to the shoulder strap using a clasp, hook or other fastener attached to the flap, and a corresponding fastener attached to the shoulder strap;

and in which the bra adjuster is attachable at one end to the fastener attached to the flap, and at its other end to the fastener attached to the shoulder strap, and hence increases the effective bra cup size sufficiently to accommodate a wearable breast pump, and is also detachable from the flap and shoulder strap.

Optional:

- Bra adjuster is retained in position on the bra during normal wearing of the bra, even when the flap is attached directly to the shoulder strap, and is used to increases the effective bra cup size only when the wearable breast pump is used.
- Bra adjuster is extensible or elastic.
- Bra adjuster is of a fixed length.
- Bra adjuster includes a clip that the user can slide onto the bra strap to secure the bra adjuster in position.
- Bra adjuster is machine-washing washable.

F. Other Features that can sit outside the breast pump context

Feature 41 Wearable device using more than one piezo pump connected in series or in parallel

A wearable device including multiple piezo pumps mounted together either in series or in parallel.

Optional:

- The wearable device is a medical wearable device.
- The piezo pumps air or any liquid etc.
- The system can switch between a parallel mode and a series mode to arrive to lower or higher pressure quicker.

Feature 42 Wearable medical device using a piezo pump and a heat sink attached together.

A wearable medical device including a piezo pump and a heat sink attached together.

Optional

- The wearable device uses more than one piezo pump connected in series.
- The wearable device uses more than one piezo pump connected in parallel.
- Each piezo pump is connected to its own heat sink, or to a common heat sink.
- The or each heat sink is configured to ensure that the maximum temperature of any parts of the breast pump system that might come into contact with the skin, especially prolonged contact for greater than 1 minute, are no more than 48°C and preferably no more than 43°C
- The wearable device includes a thermal cut out.
- Excess heat is diverted to a specific location on the device that is selected to not be in prolonged contact with the skin of the user, in normal use.
- Use cases application:
  - Wound therapy
  - High degree burns
  - Sleep apnea
  - Deep vein thrombosis
  - Sports injury.
- Wearable medical device is powered/charged via USB.

Note

It is to be understood that the above-referenced arrangements are only illustrative of the application for the principles of the present invention. Numerous modifications and alternative arrangements can be devised without departing from the spirit and scope of

the present invention. While the present invention has been shown in the drawings and fully described above with particularity and detail in connection with what is presently deemed to be the most practical and preferred example(s) of the invention, it will be apparent to those of ordinary skill in the art that numerous modifications can be made without departing from the principles and concepts of the invention as set forth herein.

CLAIMS

1. A breast pump device that is configured as a self-contained, in-bra wearable device, and that includes:

(i) a housing that includes (a) a rechargeable battery; (b) a power charging circuit for controlling the charging of the rechargeable battery; (c) control electronics powered by the rechargeable battery; (d) a pump powered by the rechargeable battery and generating negative air pressure with a maximum suction of approximately 240mmHg;

(ii) a breast shield made up of a breast flange and a nipple tunnel; and

(iii) a milk container that is configured to be attached to and removed from the housing.

2. The breast pump device of Claim 1, in which the pump comprises a piezo air pump system

3. The breast pump device of Claim 1, in which the pump is positioned at or close to the base of the housing.

4. The breast pump device of Claim 1, in which the pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow and is a lightweight air pump that enables the total mass of the breast pump system, unfilled with milk, to be less than 250gm

5. The breast pump device of Claim 1, in which the breast pump device makes less than 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.

6. The breast pump device of Claim 1, in which the breast shield is substantially rigid.

7. The breast pump device of Claim 1, in which the breast shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto the breast.

8. The breast pump device of Claim 1, in which the breast shield is a one piece item that in use presents a single continuous surface to the nipple and breast.

9. The breast pump device of Claim 1, in which the breast shield integrates the breast flange and nipple tunnel as a one-piece item.

10. The breast pump device of Claim 1, in which the breast flange and the nipple tunnel are a single, integral item with no joining stubs.

11. The breast pump device of Claim 1, in which the breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.

12. The breast pump device of Claim 1, in which the breast shield is configured to slide in and out from the housing, together with the diaphragm that prevents milk from reaching the pump, on guide members in the breast shield.

13. The breast pump device of Claim 1, in which the housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.

14. The breast pump device of Claim 1, in which the breast pump device includes only two parts that are directly removable from the housing in normal use or normal dis-assembly: the breast shield and the milk container.

15. The breast pump device of Claim 1, in which the device includes a diaphragm that prevents milk from reaching the pump, and the diaphragm is a flexible membrane.

16. The breast pump device of Claim 1, in which the diaphragm is substantially circular and is configured to self-seal under the negative air pressure to a substantially circular diaphragm holder that is part of the housing.

17. The breast pump device of Claim 1, in which the diaphragm is a membrane that is seated against a diaphragm holder that is formed as the recess in the

rear surface of the housing, the diaphragm deforming in response to changes in air pressure caused by the air pump to create negative air pressure in the nipple tunnel.

18. The breast pump device of Claim 1, in which the diaphragm is removable from a diaphragm holder that sits above the breast flange and the nipple tunnel portion

19. The breast pump device of Claim 1, in which the milk container is substantially rigid.

20. The breast pump device of Claim 1, in which the milk container is configured to attach to a lower part of the housing and to form a flat bottomed base for the device.

21. The breast pump device of Claim 1, in which the milk container has a surface shaped to continue a curved shape of the housing, so that the entire device can be held comfortably inside the bra.

22. The breast pump device of Claim 1, in which the milk container includes a flexible valve that self-seals under negative air pressure against a milk opening in the nipple tunnel and that permits milk to flow into the milk container.

23. The breast pump device of Claim 1, in which the milk container is attachable to the housing with a mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.

24. The breast pump device of Claim 1, in which the milk container includes a cap that is removable from the milk container and a removable valve that enables milk to pass into the milk container in one direction.

25. The breast pump device of Claim 1, in which the top of the container includes an optically clear region that is aligned below one or more light emitters positioned in the base of the housing.

26. The breast pump device of Claim 1, in which the milk container is shaped or configured to also serve as a drinking bottle that is readily held by a baby because it is wider than it is tall.

27. The breast pump device of Claim 1, in which the housing includes a wireless data communications system powered by the rechargeable battery.

28. The breast pump device of Claim 1, in which the housing has a front surface that is configured to fit inside a bra and to contact an inner surface of the bra, and a rear surface that is shaped to contact, at least in part, the breast shield.

29. The breast pump device of Claim 1, in which the housing includes a visual and/or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

30. The breast pump device of Claim 1, in which the housing includes a visual and/or haptic indicator that indicates if the pump is operating correctly to pump milk, based on whether the quantity and/or the height of the liquid in the milk container above its base is increasing above a threshold rate of increase.

ABSTRACT

The invention is a wearable breast pump system including a housing shaped at least in part to fit inside a bra and a piezo air-pump. The piezo air-pump is fitted in the housing and forms part of a closed loop system that drives a separate, deformable diaphragm to generate negative air pressure. The diaphragm is removably mounted on a breast shield.

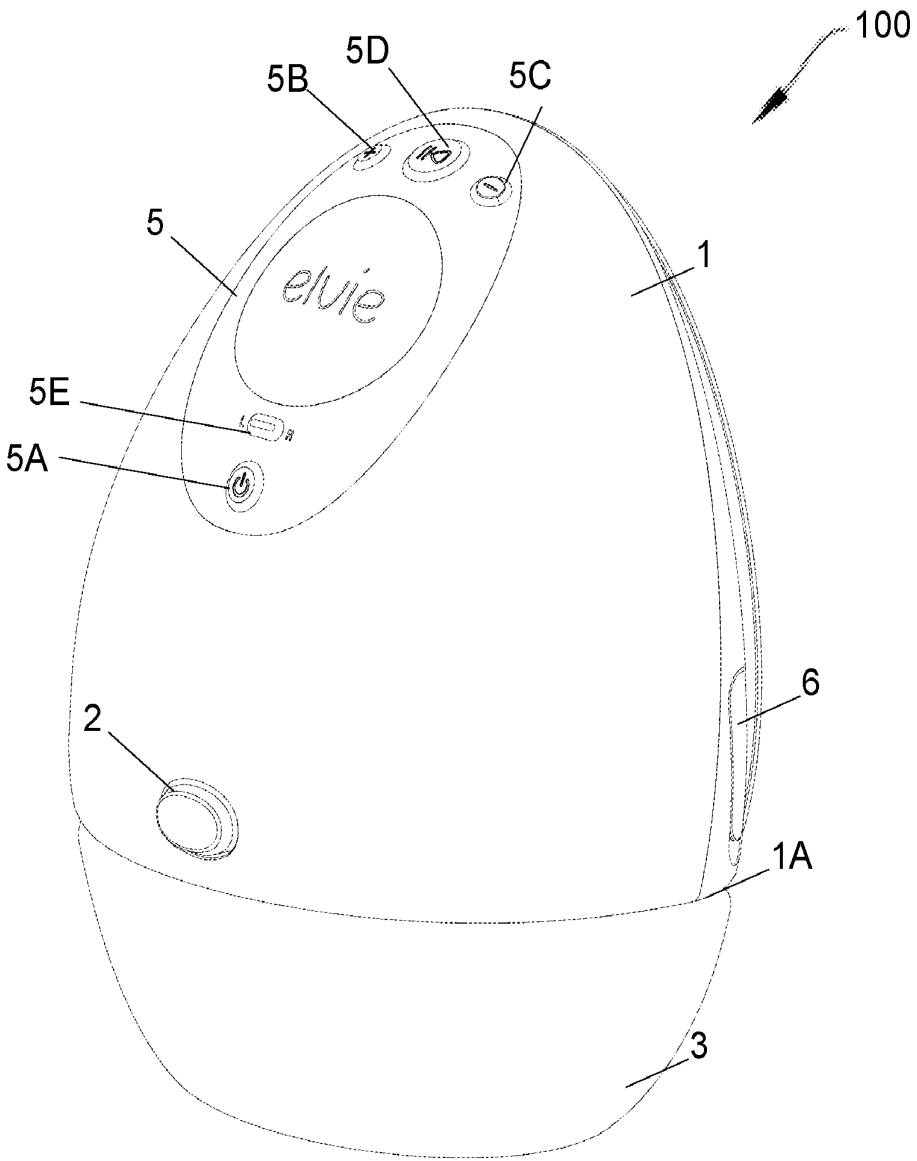


FIGURE 1

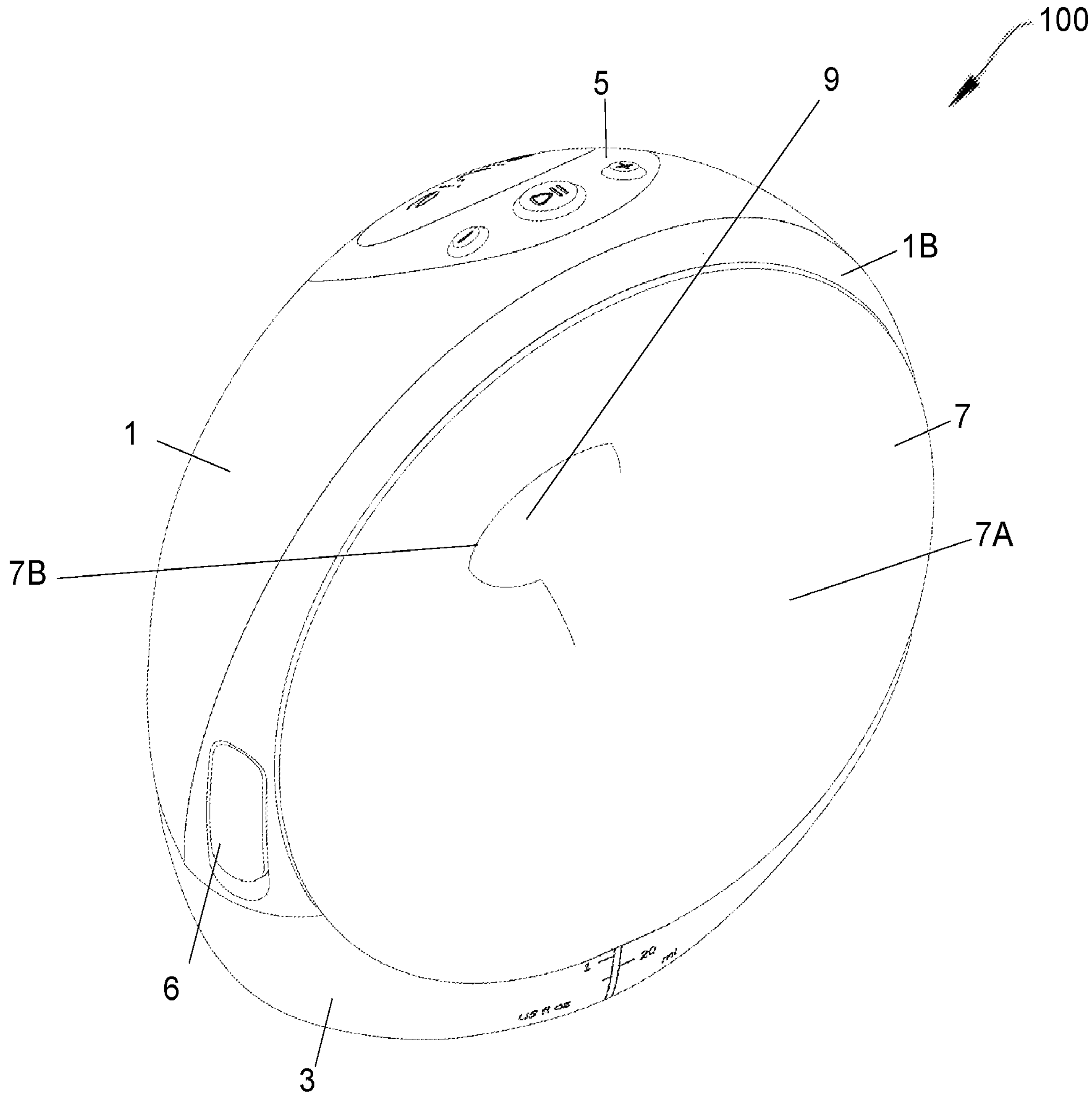


FIGURE 2

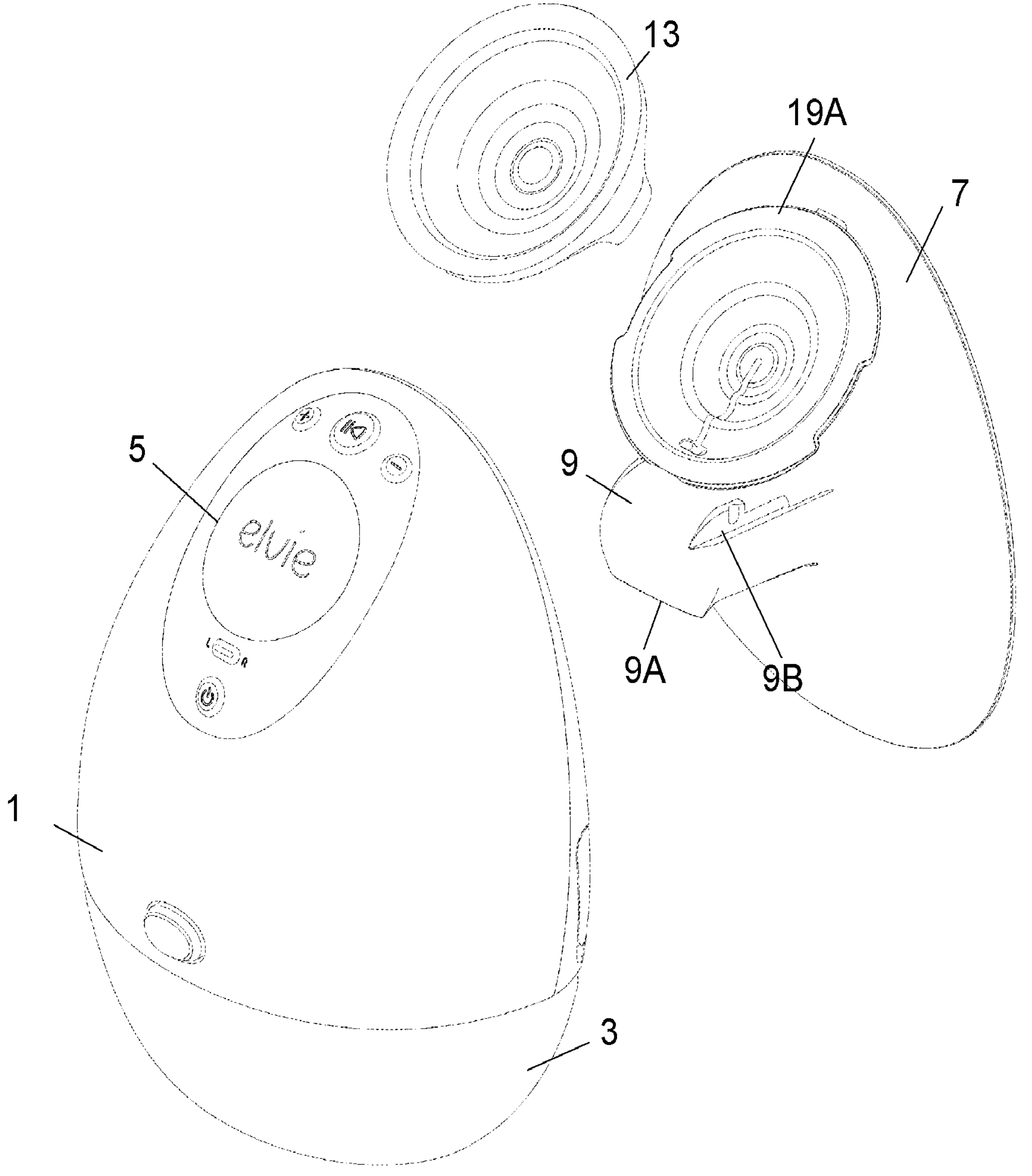


FIGURE 3

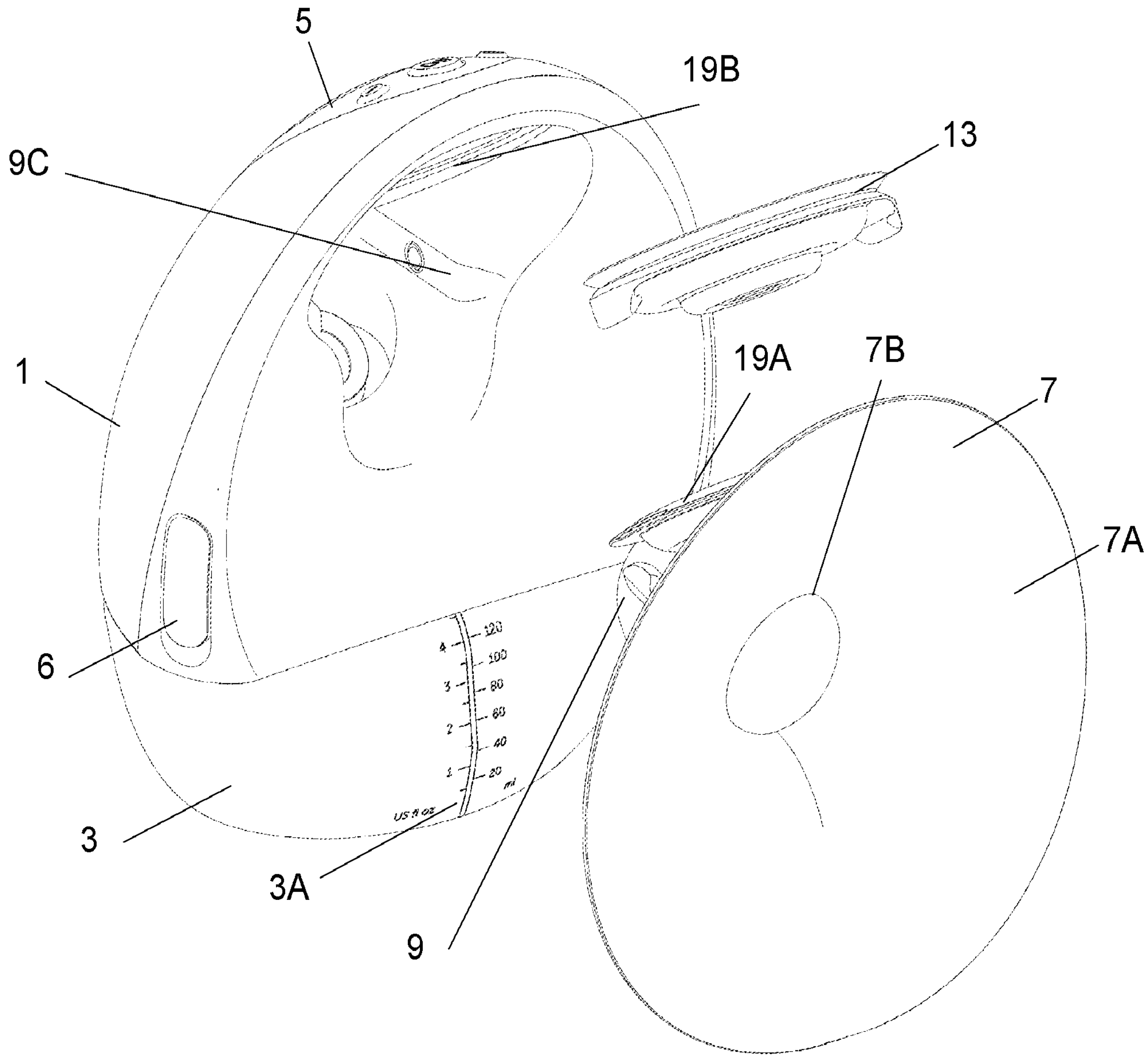


FIGURE 4

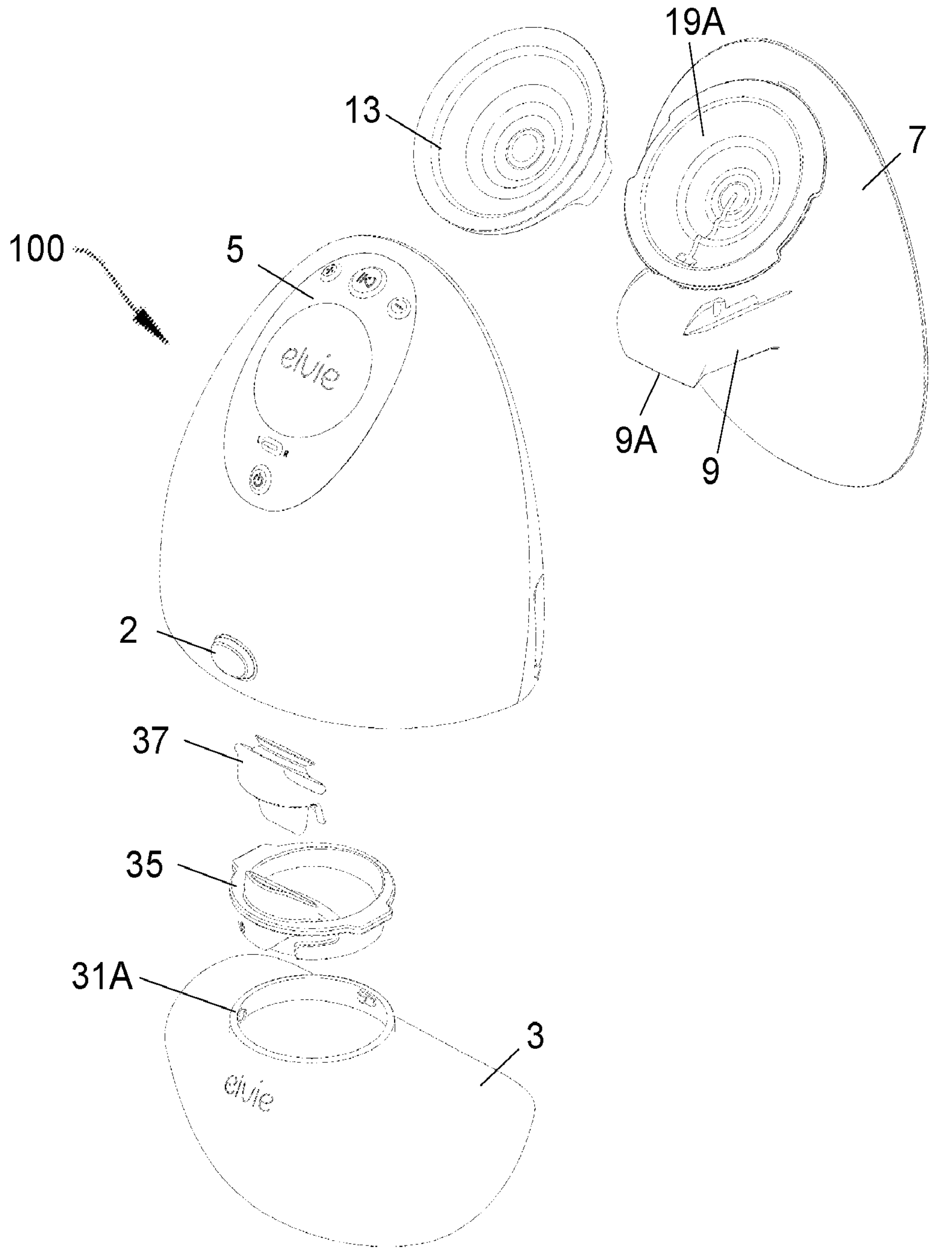


FIGURE 5

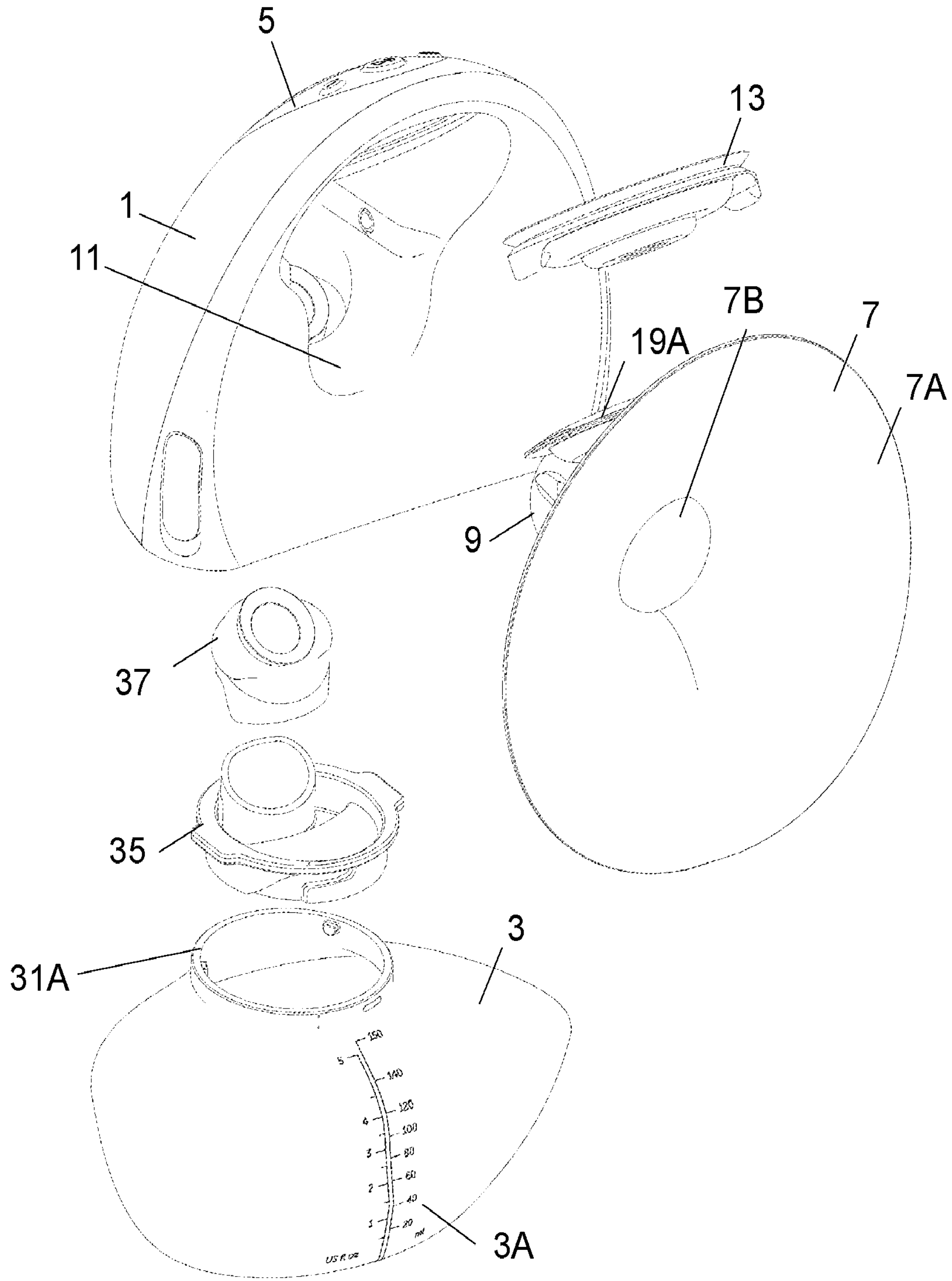


FIGURE 6

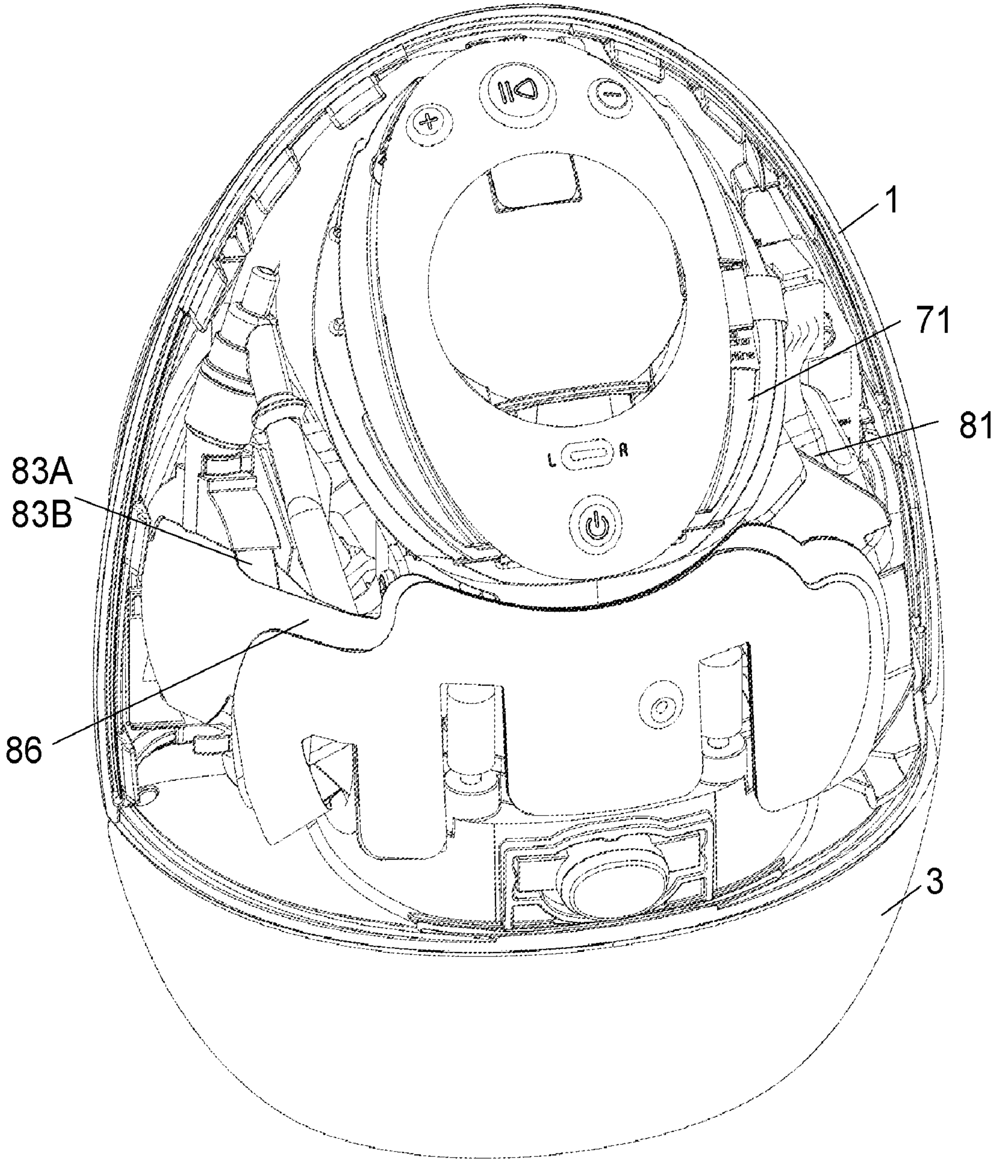
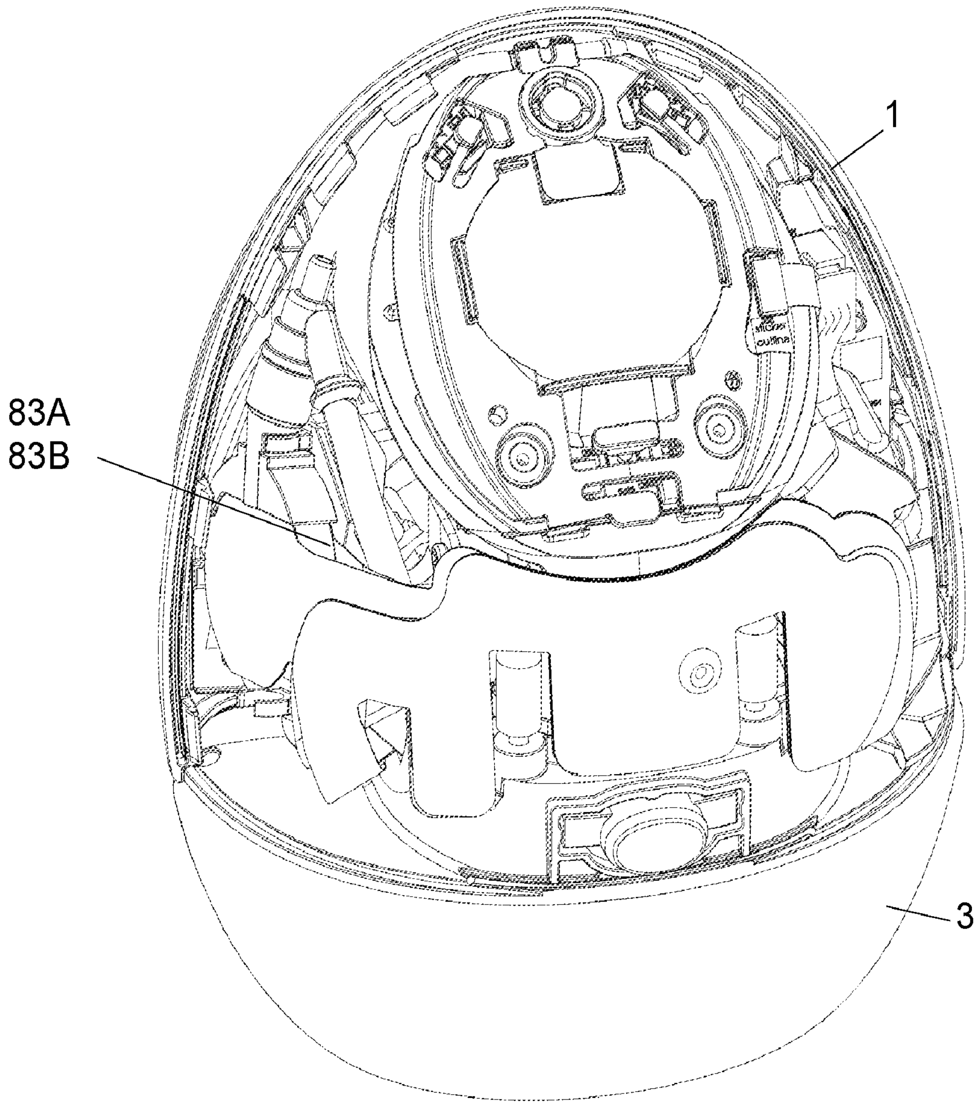


FIGURE 7



8/44

FIGURE 8

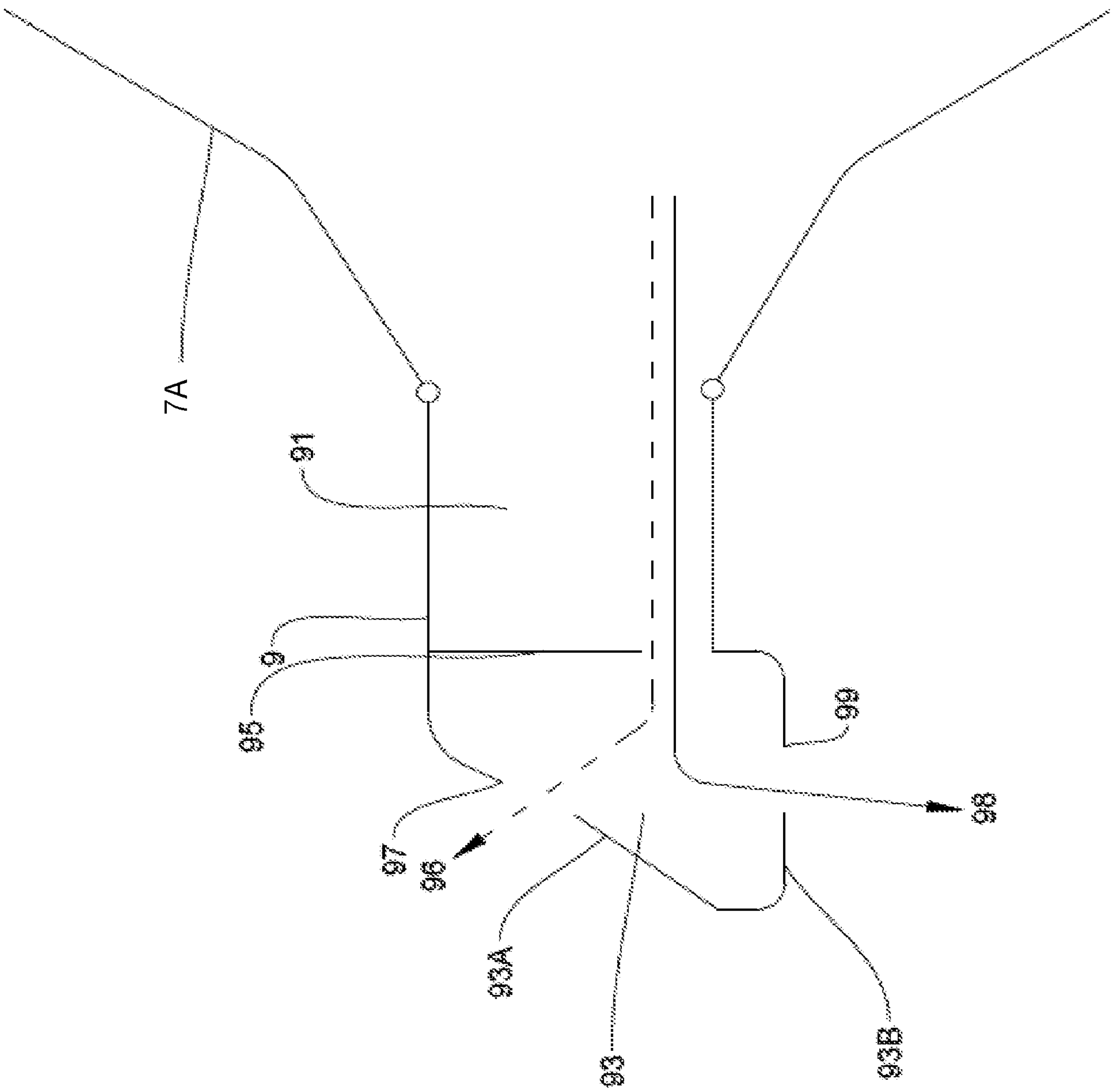


FIGURE 9

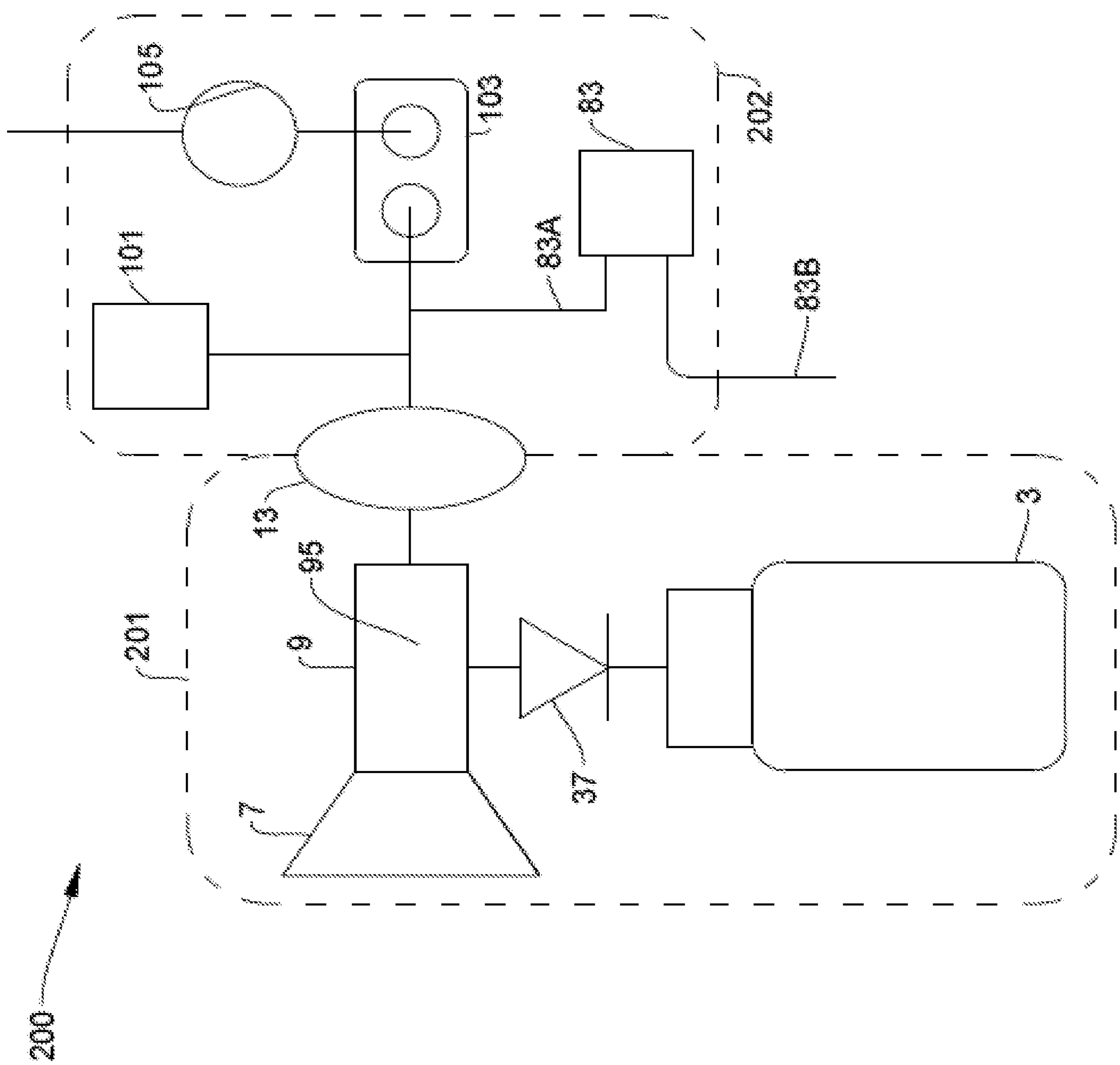


FIGURE 10

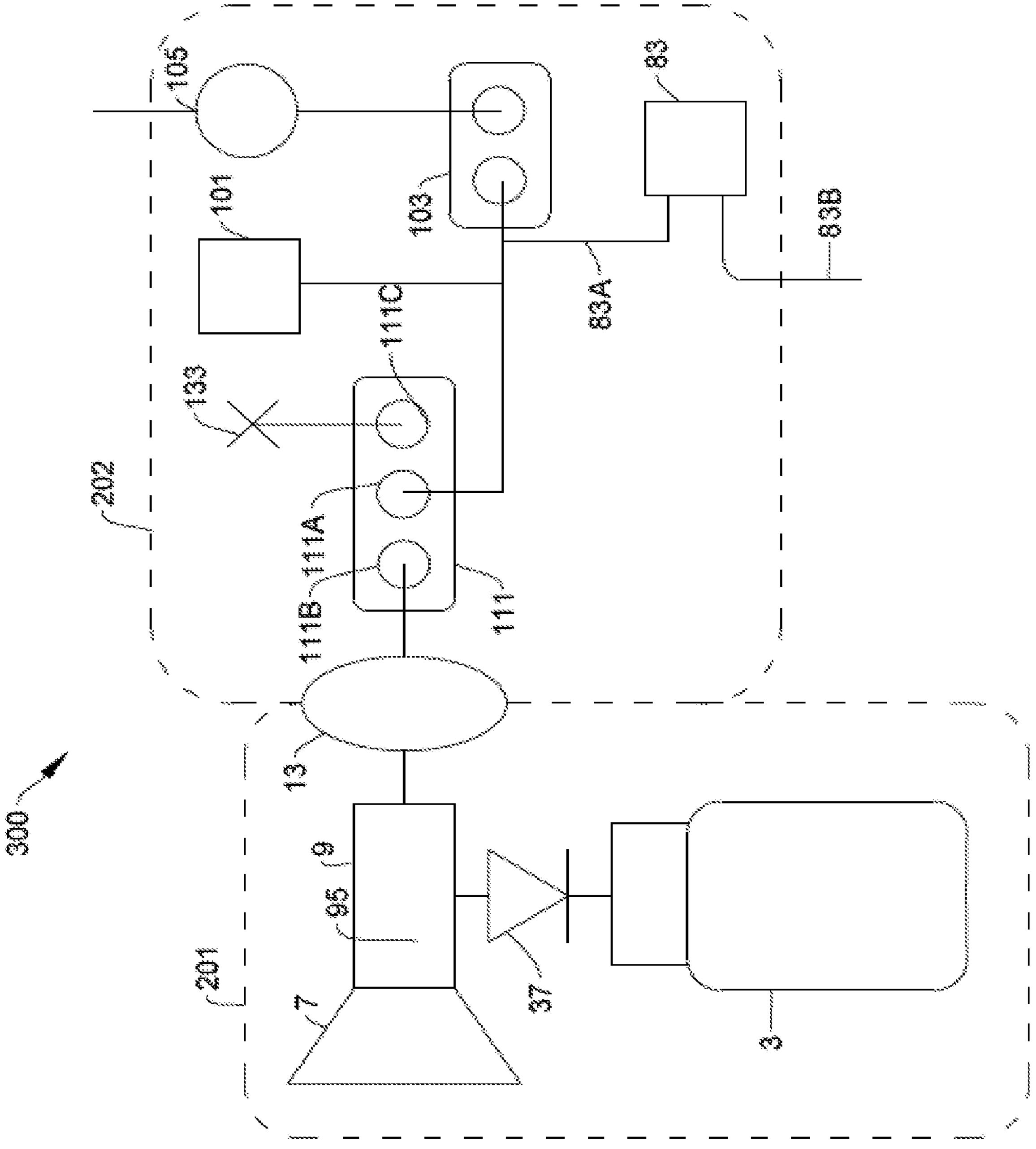

300
202
201
105
101
103
83
83A
83B
111C
133
111A
111B
111
13
9
95
7
37
3

FIGURE 11

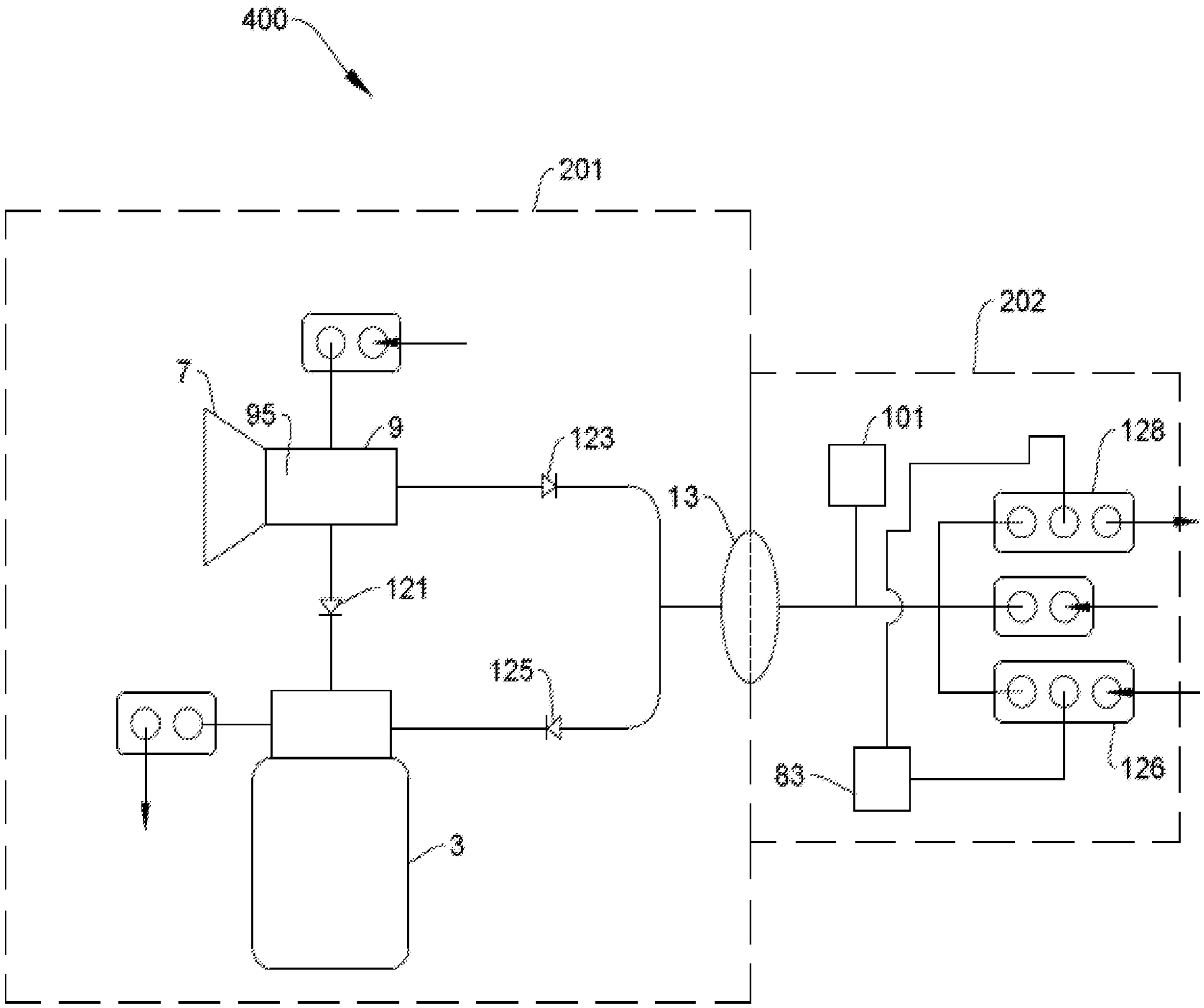
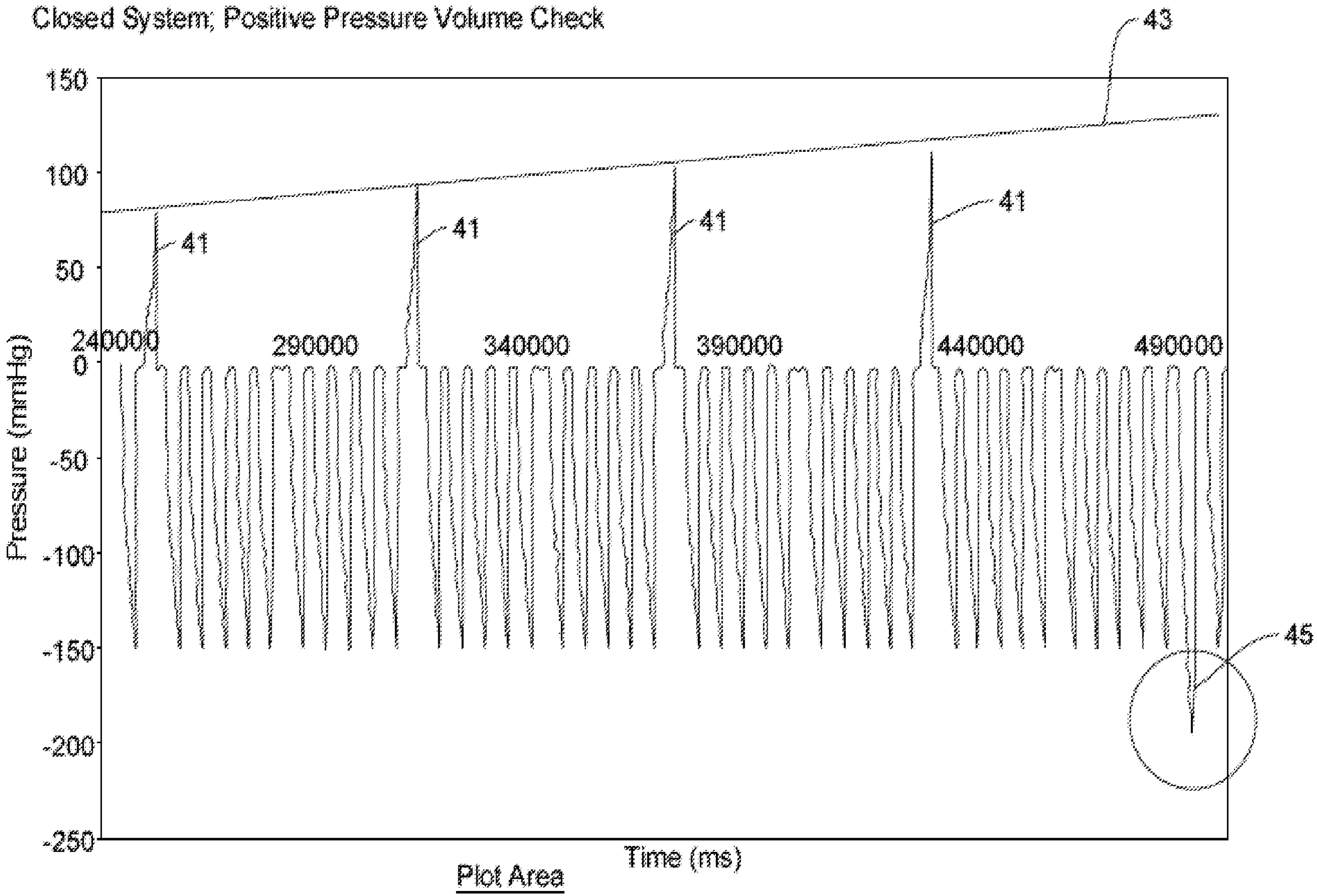


FIGURE 12



Closed System; Positive Pressure Volume Check
43
150
100
50
0
-50
-100
-150
-200
-250
Pressure (mmHg)
41
41
41
41
240000
290000
340000
390000
440000
490000
45
Time (ms)
Plot Area

FIGURE 13

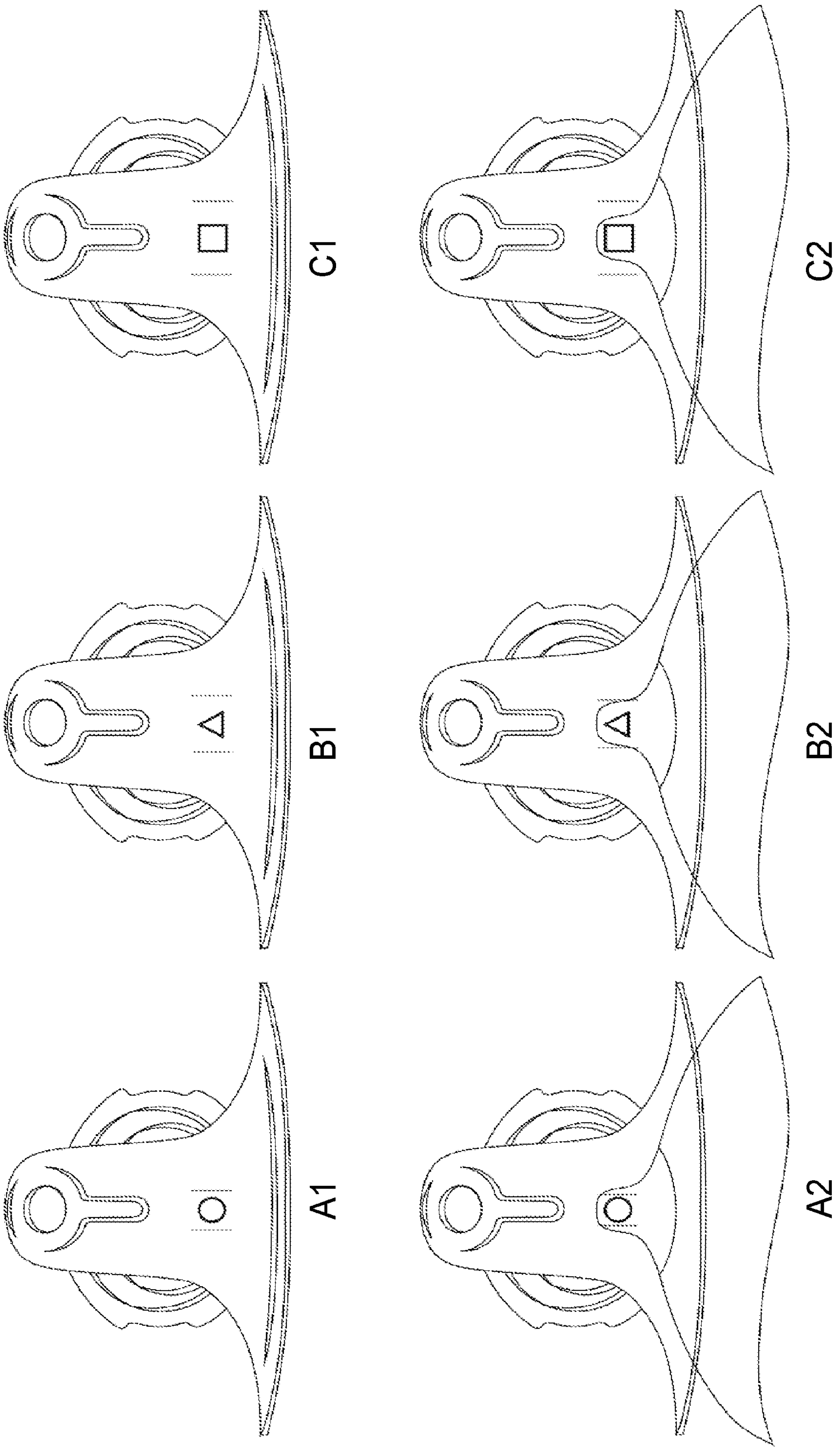


FIGURE 14

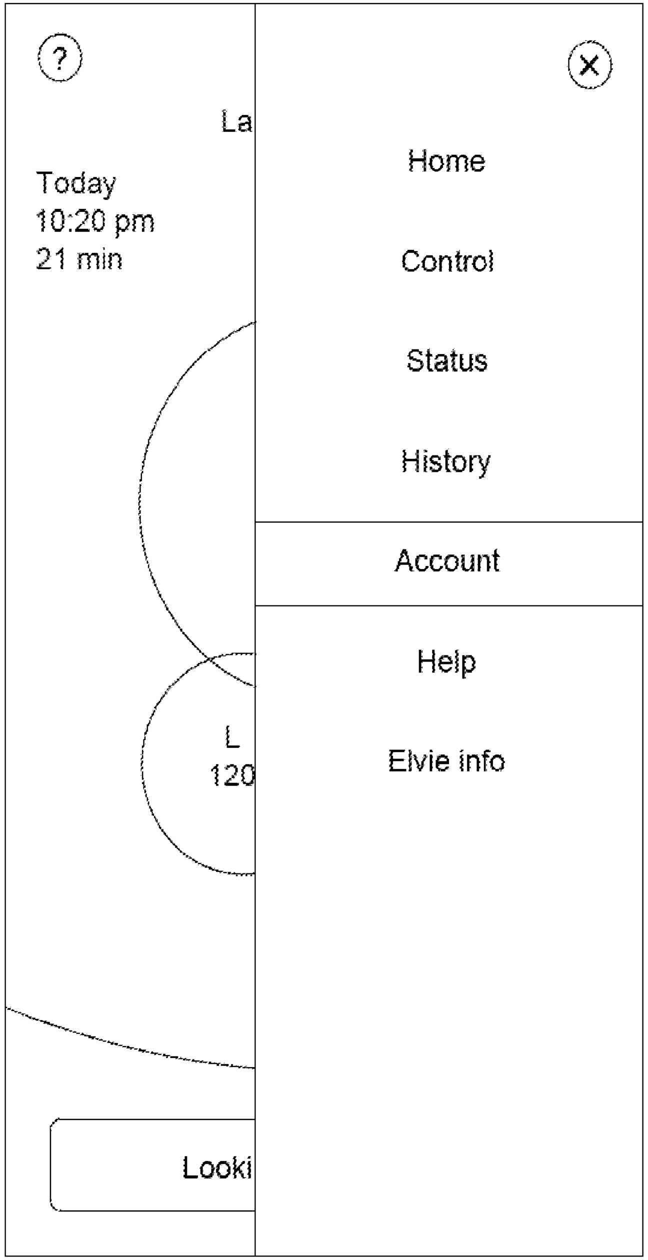

?
La
Today
10:20 pm
21 min
L
120
Looki
Home
Control
Status
History
Account
Help
Elvie info

FIGURE 15

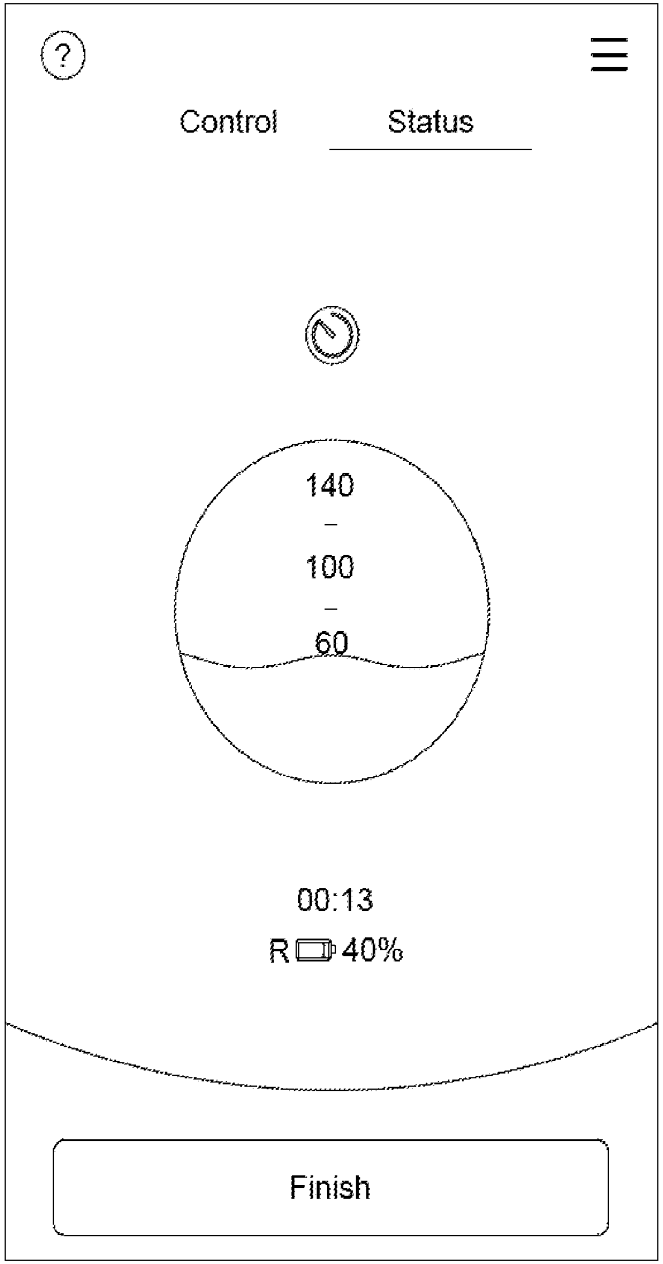
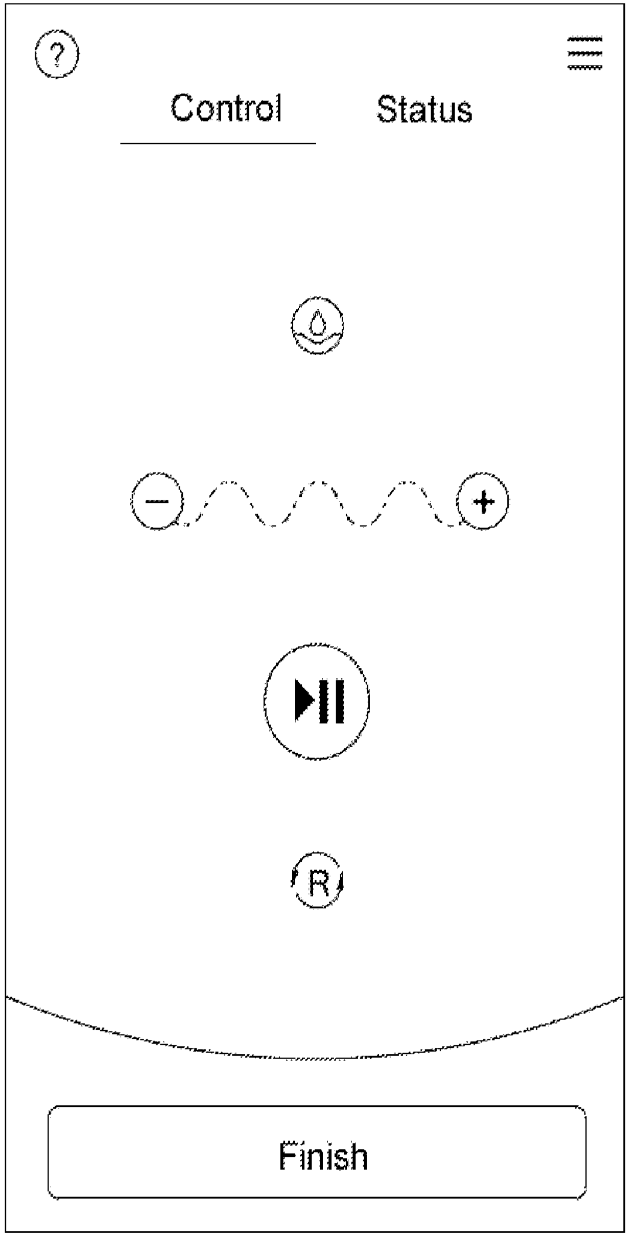
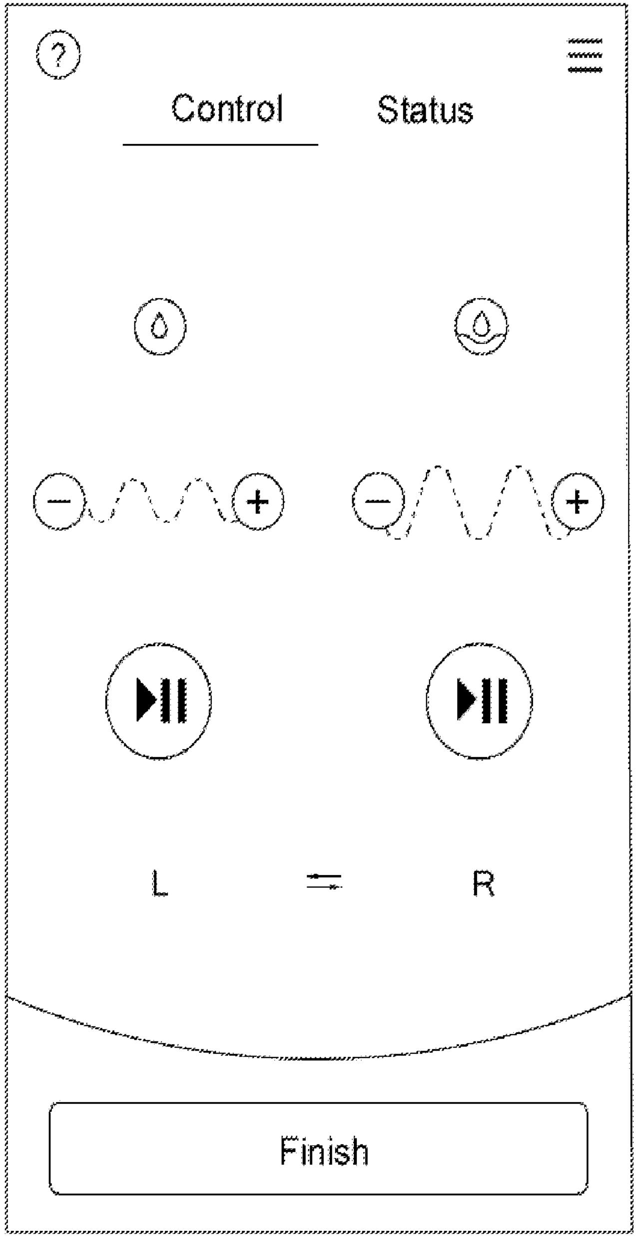


FIGURE 16



A



B

FIGURE 17

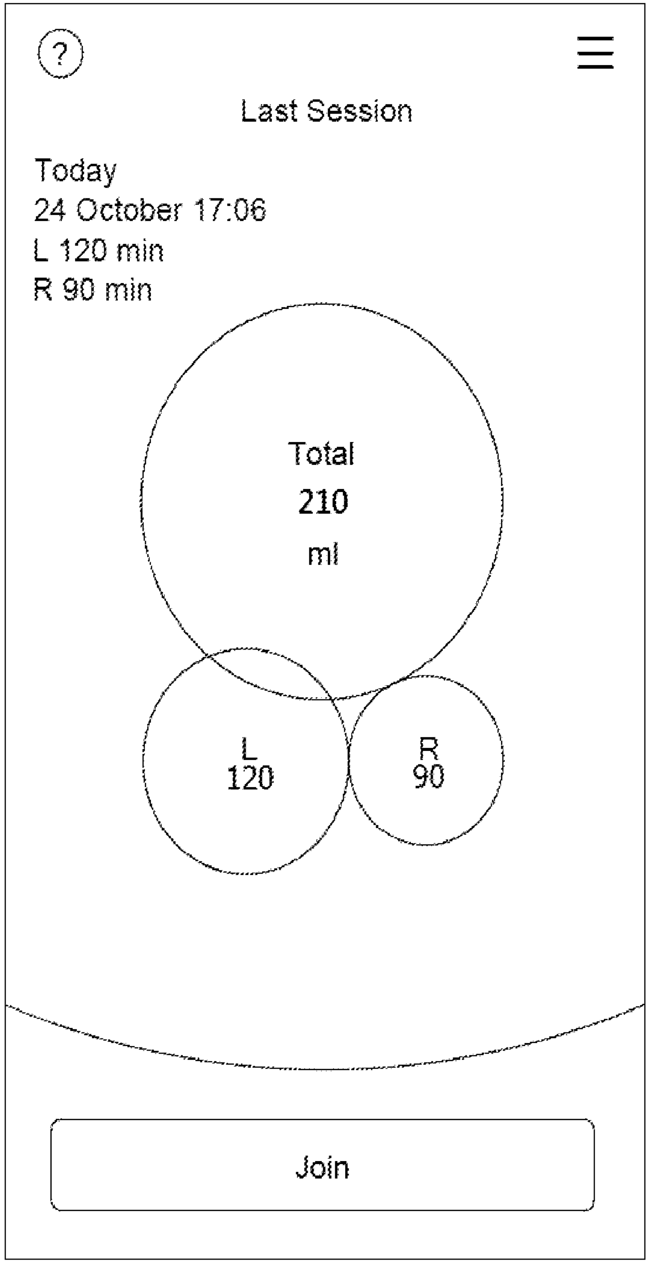

?
Last Session
Today
24 October 17:06
L 120 min
R 90 min
Total
210
ml
L
120
R
90
Join

FIGURE 18

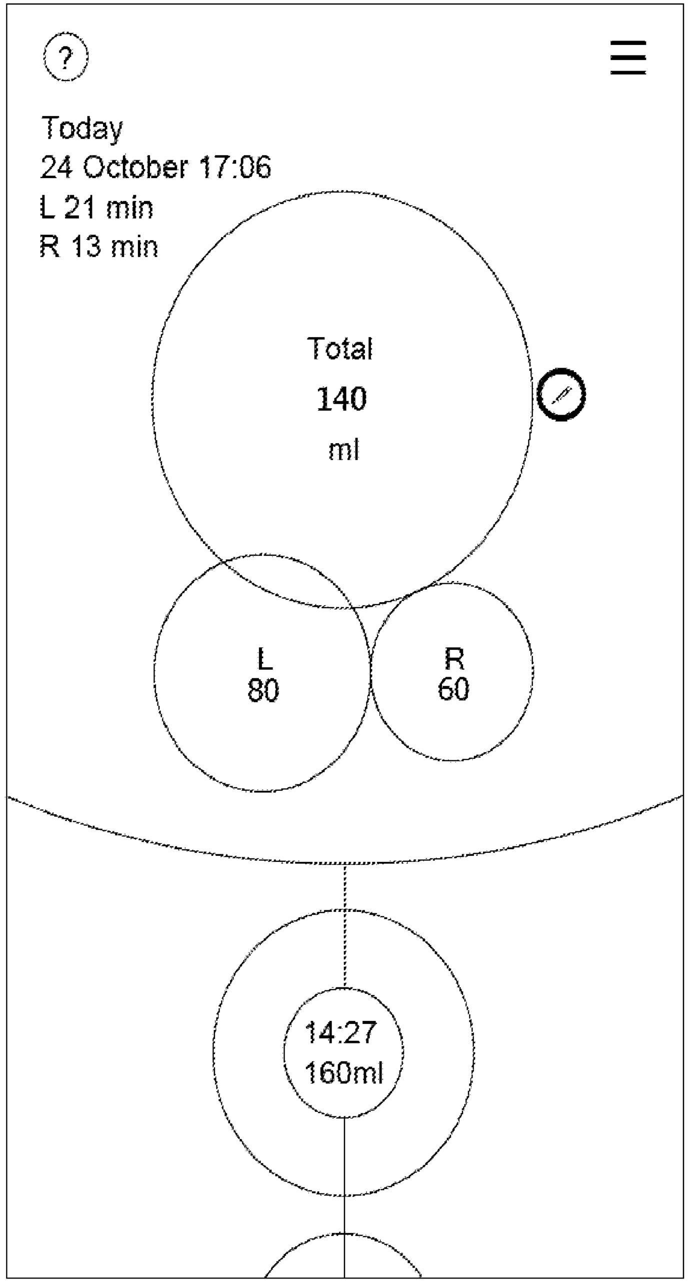

?
Today
24 October 17:06
L 21 min
R 13 min
Total
140
ml
L
80
R
60
14:27
160ml

FIGURE 19

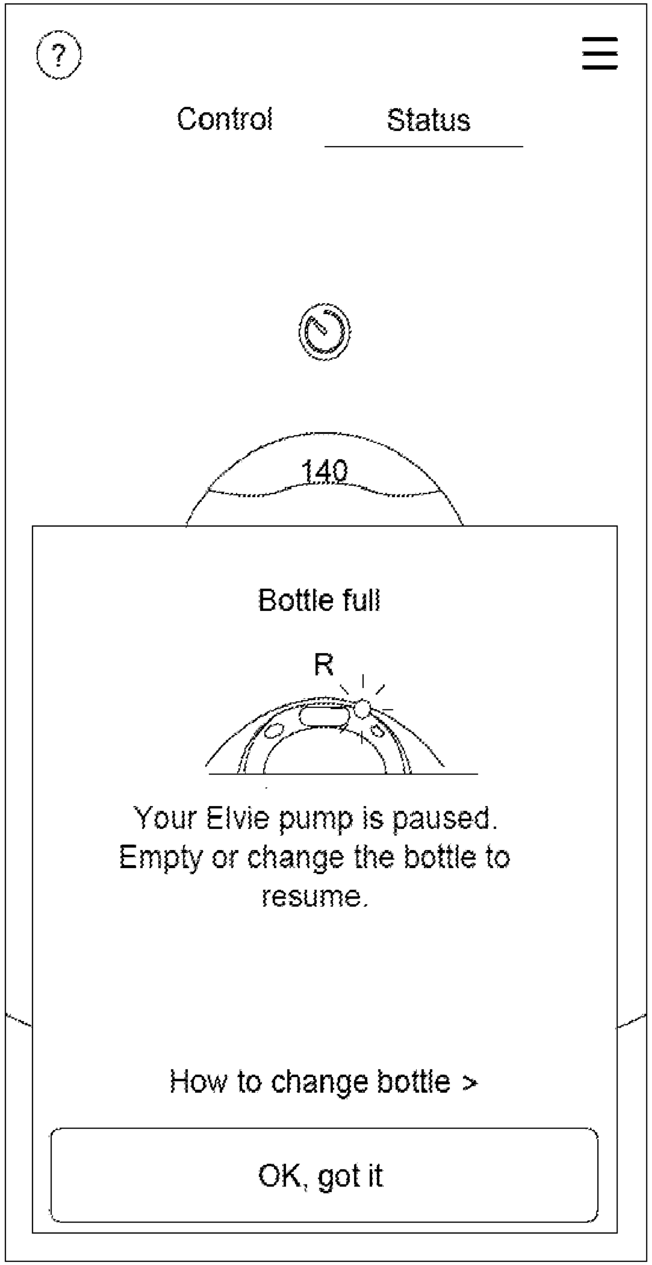

?
Control
Status
140
Bottle full
R
Your Elvie pump is paused.
Empty or change the bottle to resume.
How to change bottle >
OK, got it

FIGURE 20

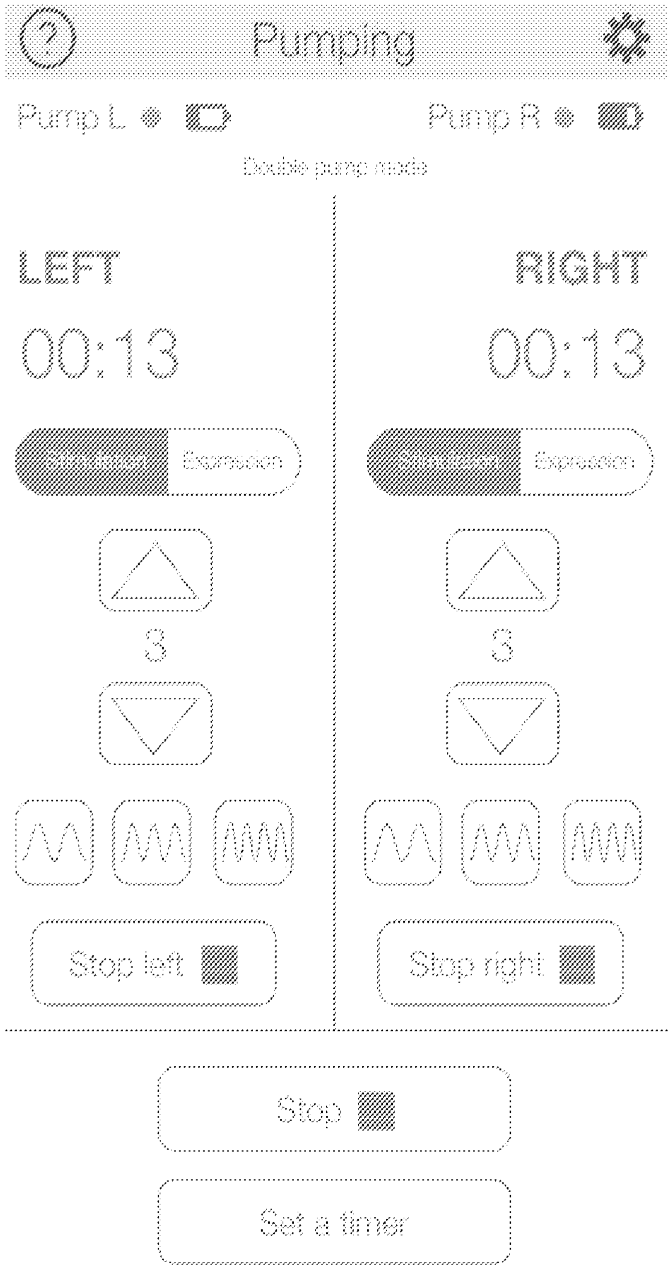

Pumping
Pump L
Pump R
Double pump mode
LEFT
RIGHT
00:13
00:13
Expression
Expression
3
3
Stop left
Stop right
Stop
Set a timer

FIGURE 21

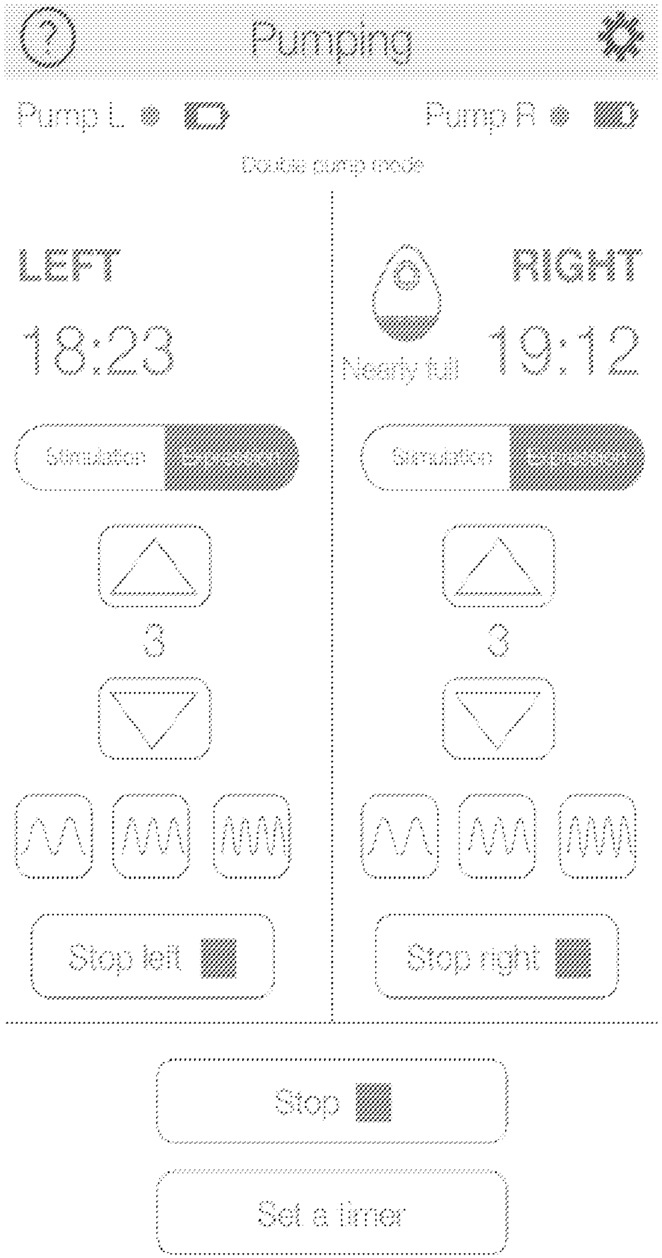

Pumping
Pump L
Pump R
Double pump mode
LEFT
18:23
RIGHT
Nearly full
19:12
Stimulation
Stimulation
3
3
Stop left
Stop right
Stop
Set a timer

FIGURE 22


Pumping
Pump L
Pump R
Pump R: bottle full
Pump paused.
Change or empty the bottle before resuming pumping.
OK
Stop
Set a timer

FIGURE 23

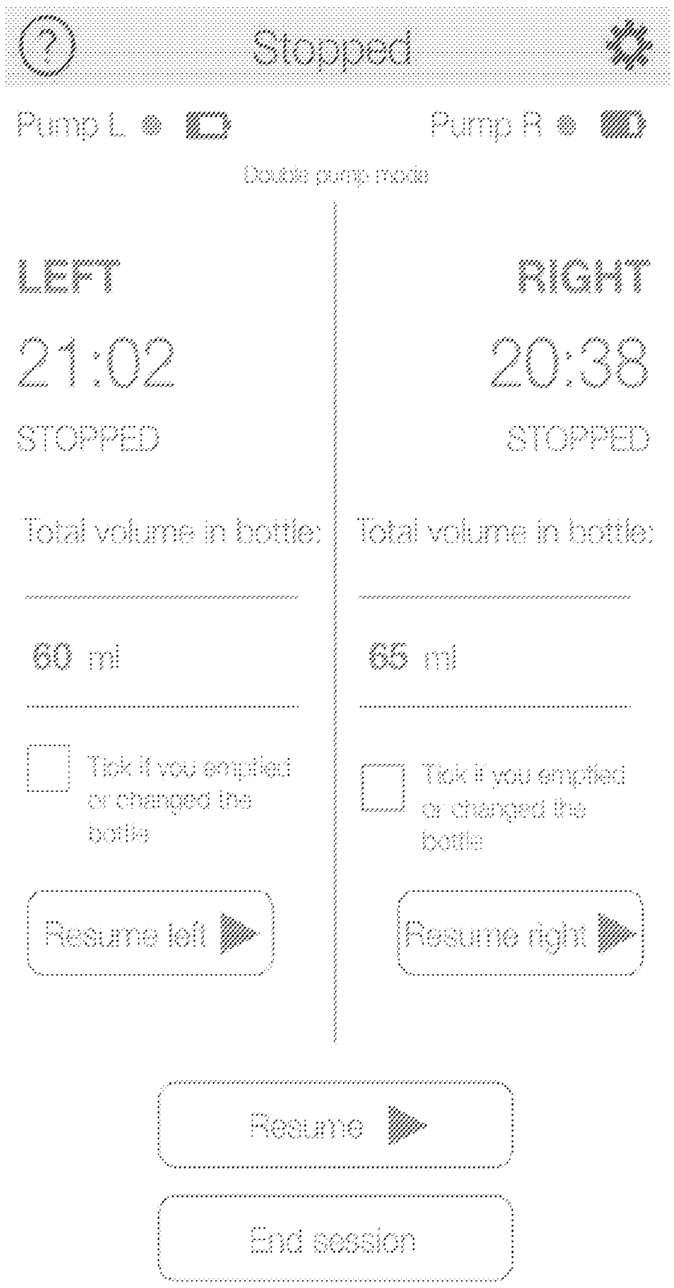

Stopped
Pump L
Pump R
Double pump mode
LEFT
21:02
STOPPED
Total volume in bottle:
60 ml
Tick if you emptied or changed the bottle
Resume left
RIGHT
20:38
STOPPED
Total volume in bottle:
65 ml
Tick if you emptied or changed the bottle
Resume right
Resume
End session

FIGURE 24

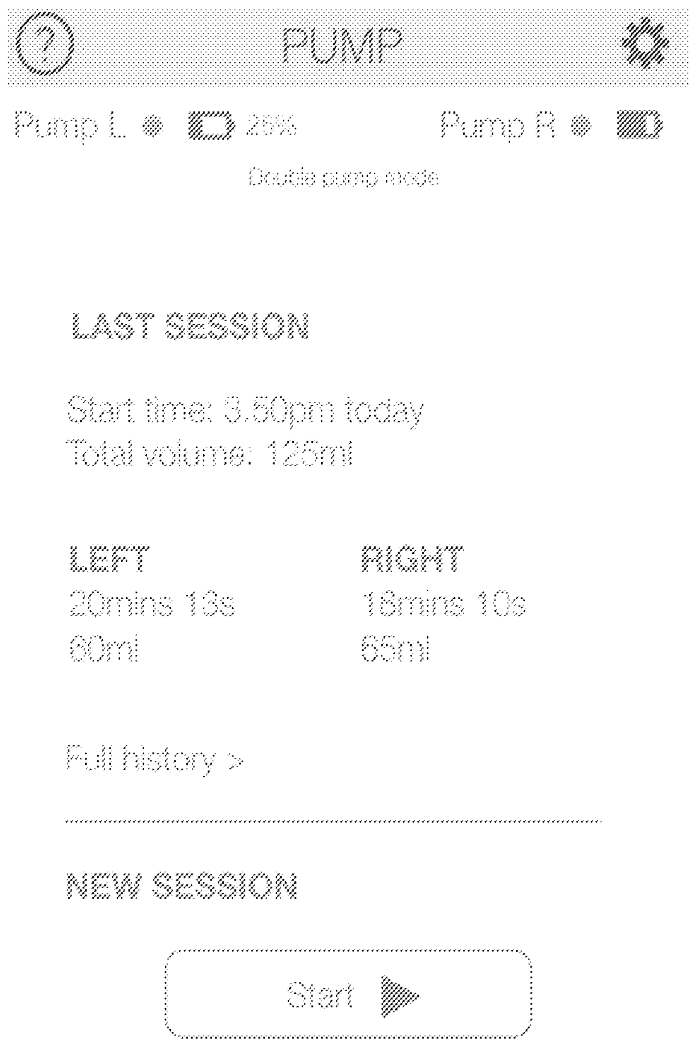

PUMP
Pump L 25%
Pump R
Double pump mode
LAST SESSION
Start time: 3.50pm today
Total volume: 125ml
LEFT
20mins 13s
60ml
RIGHT
18mins 10s
65ml
Full history >
NEW SESSION
Start

FIGURE 25

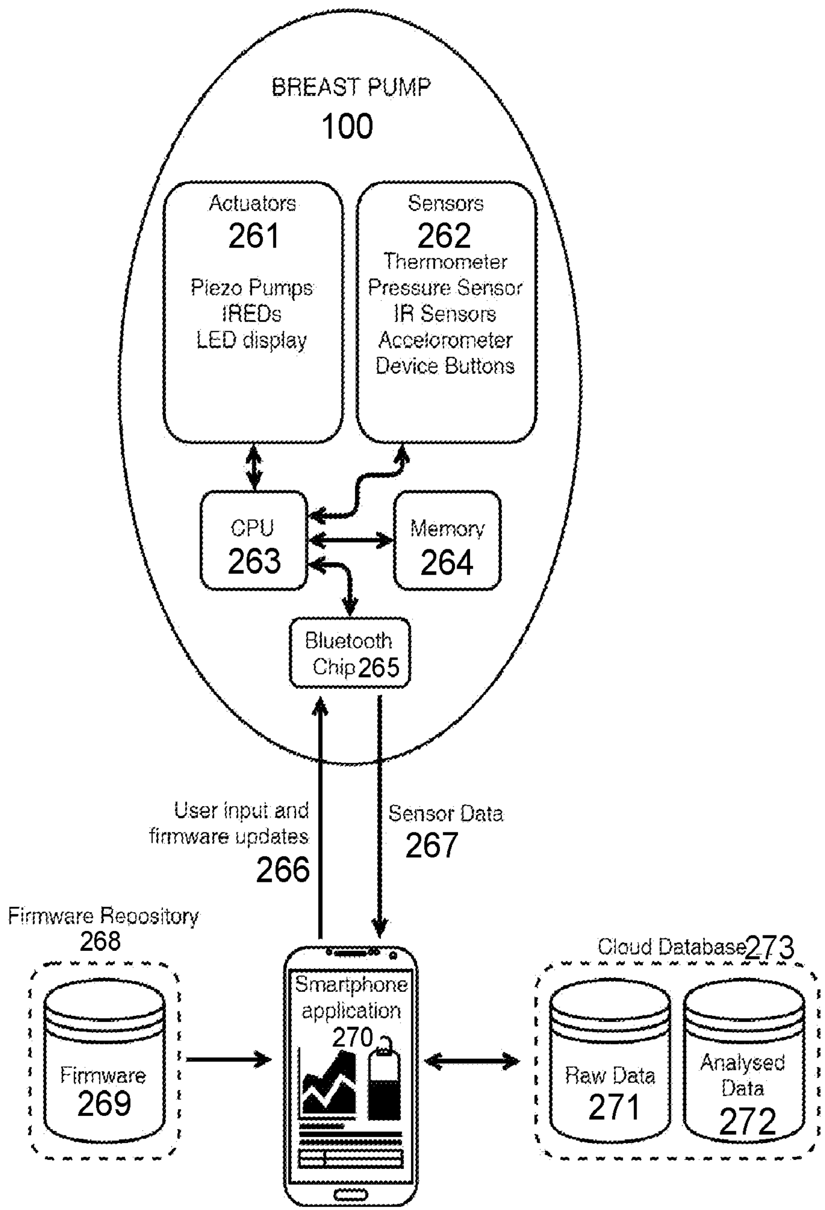

BREAST PUMP
100
Actuators
261
Piezo Pumps
IREDs
LED display
Sensors
262
Thermometer
Pressure Sensor
IR Sensors
Accelerometer
Device Buttons
CPU
263
Memory
264
Bluetooth
Chip 265
User input and
firmware updates
266
Sensor Data
267
Firmware Repository
268
Firmware
269
Smartphone
application
270
Cloud Database 273
Raw Data
271
Analysed
Data
272

FIGURE 26

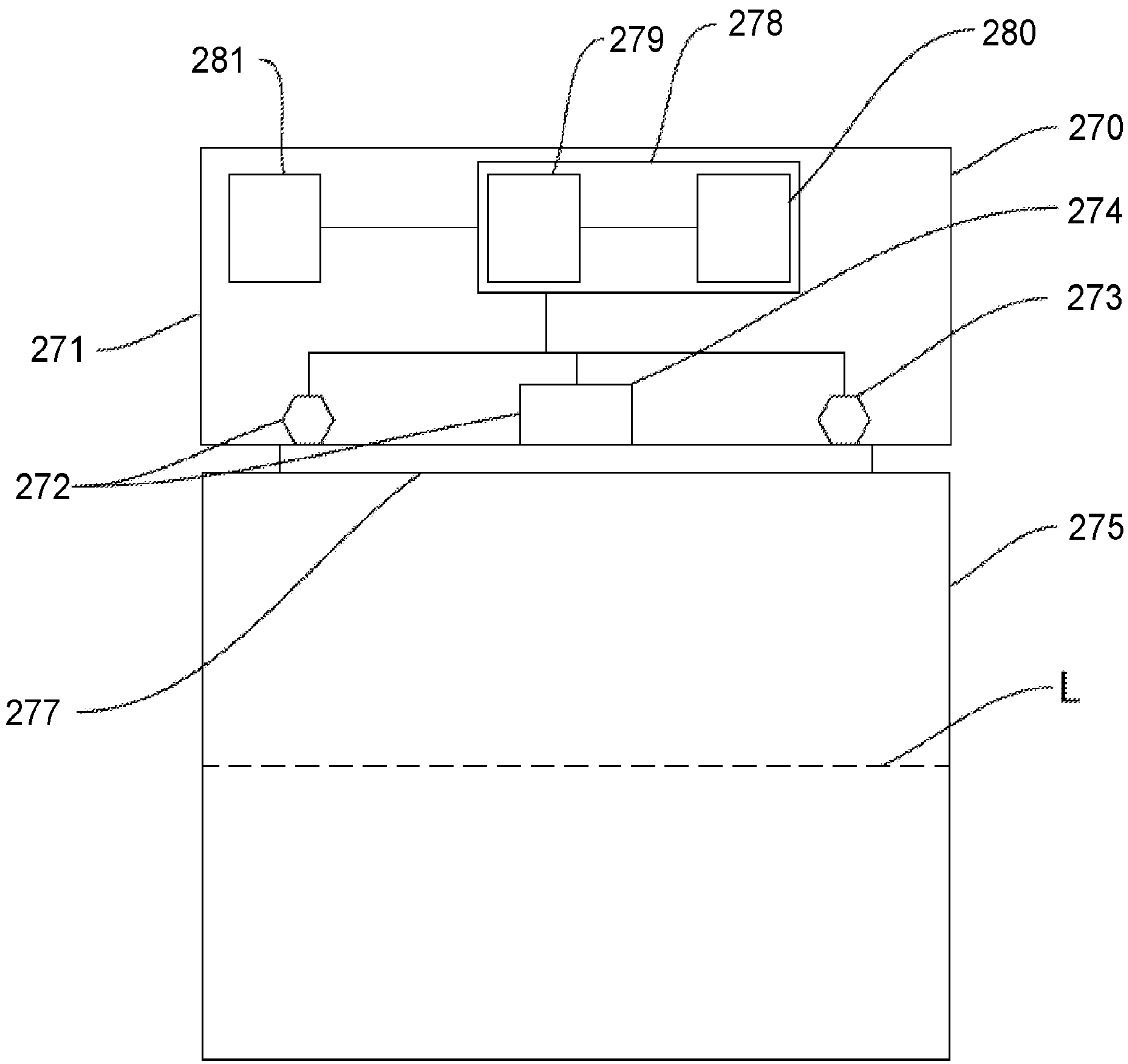


FIGURE 27

28/44

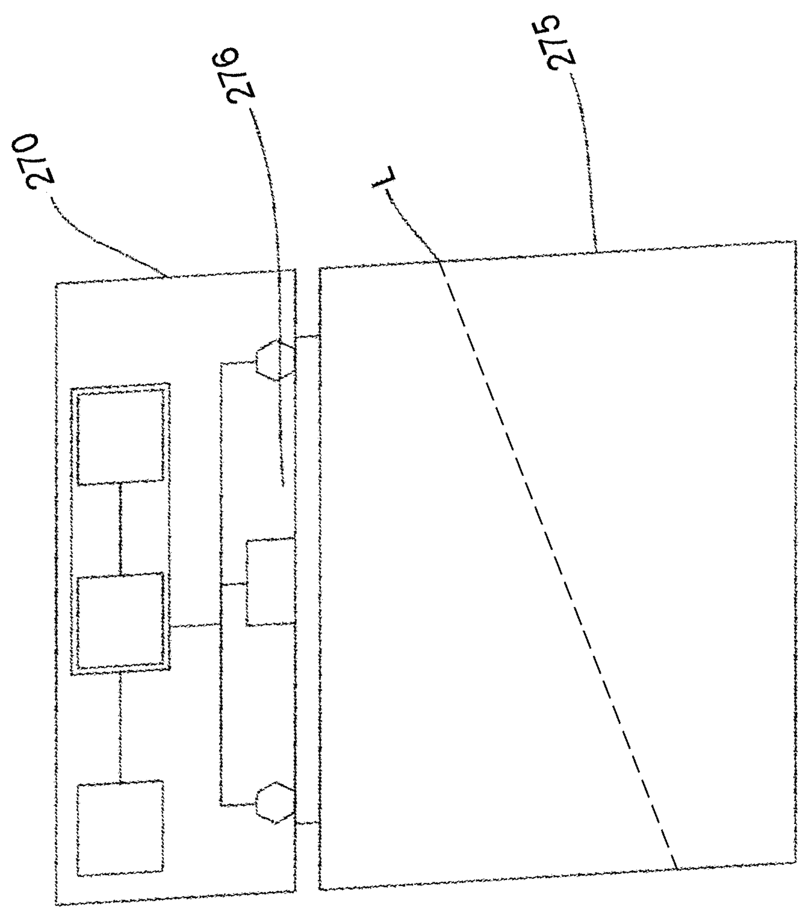


FIGURE 28

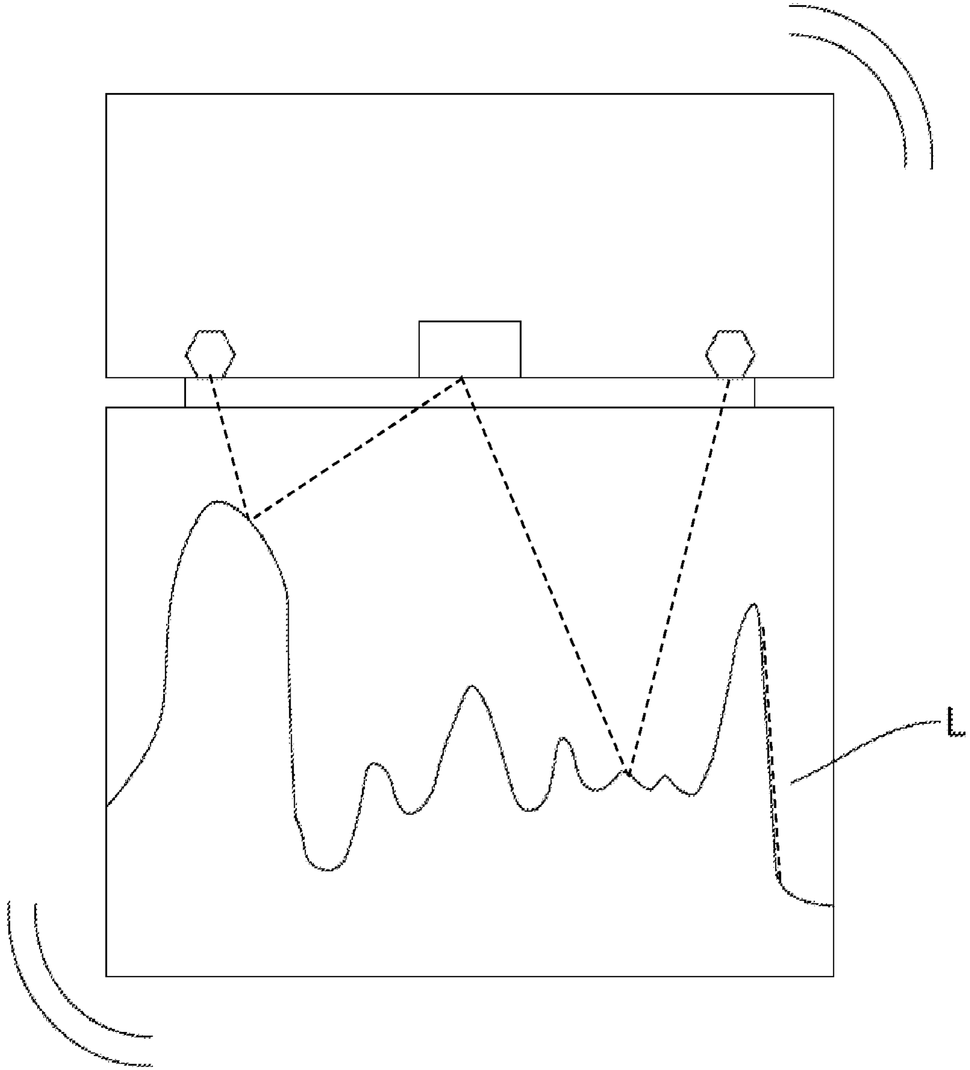


FIGURE 29

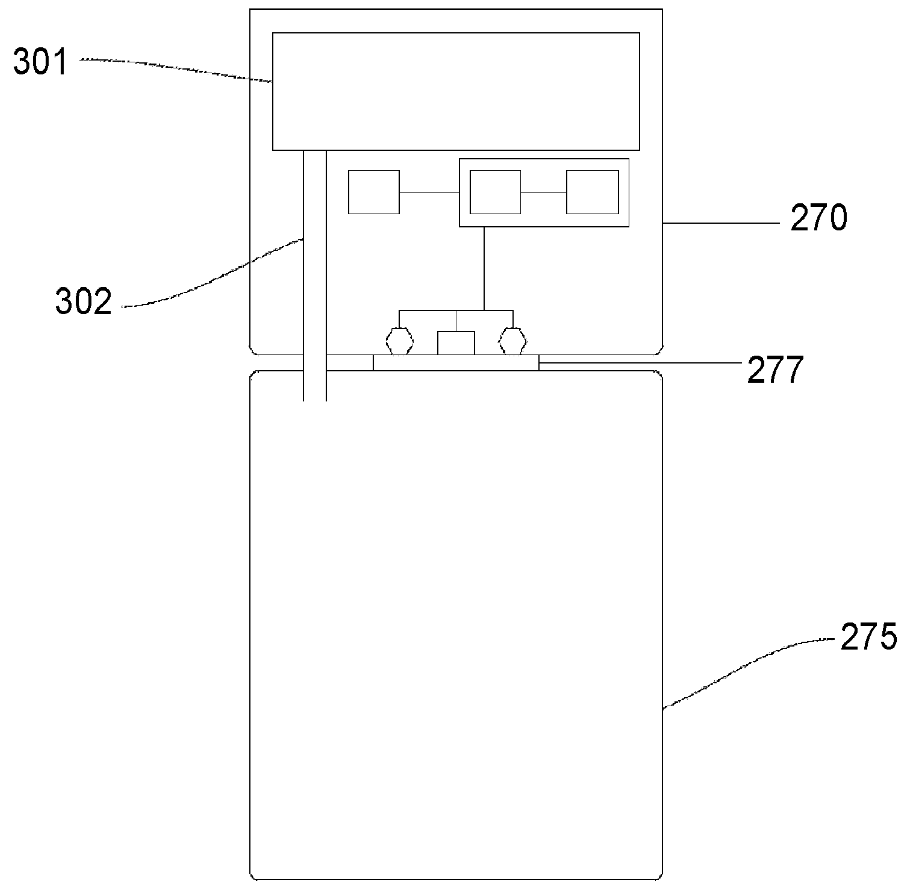


FIGURE 30

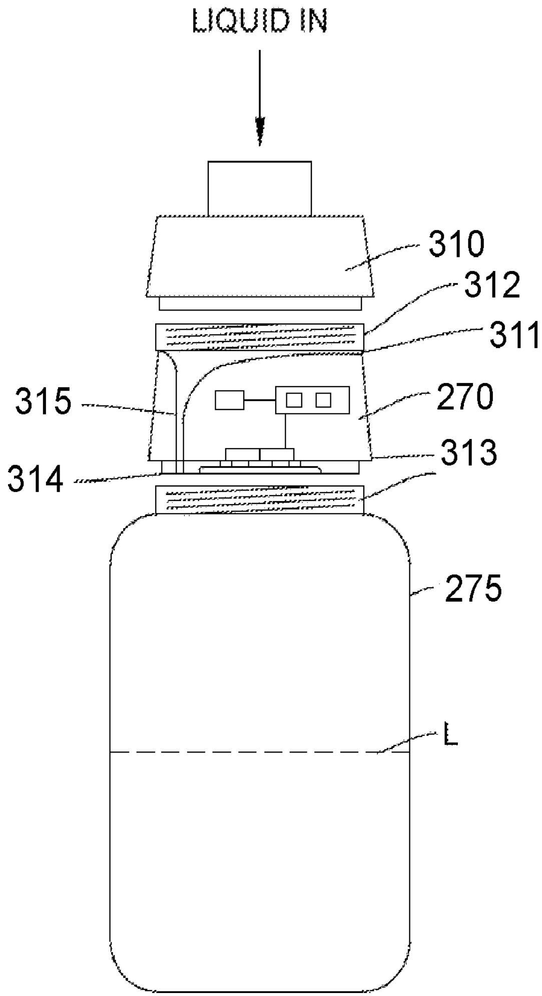


FIGURE 31

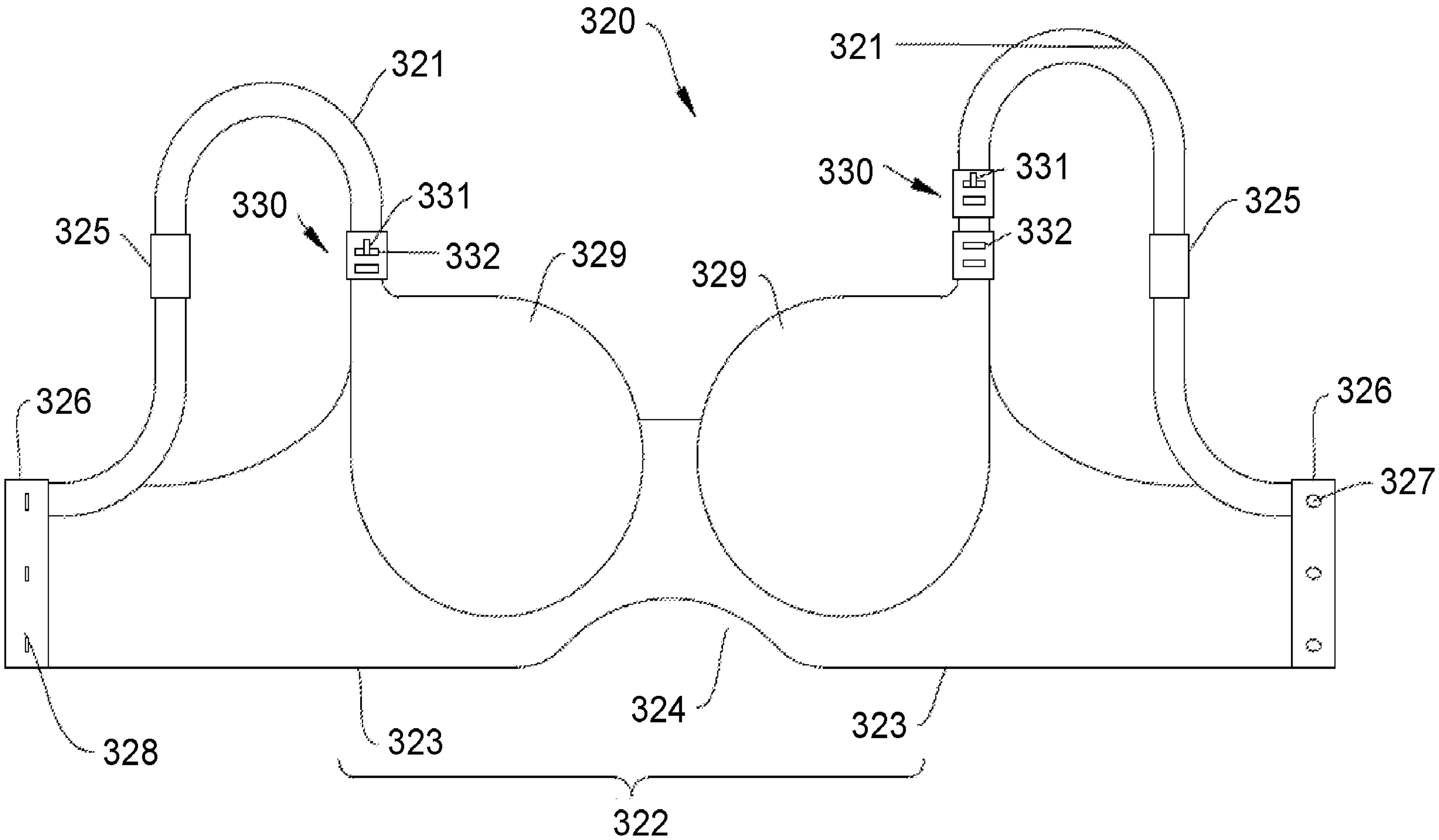

320
321
321
330
331
332
330
331
332
325
325
329
329
326
326
327
328
323
324
323
322

FIGURE 32

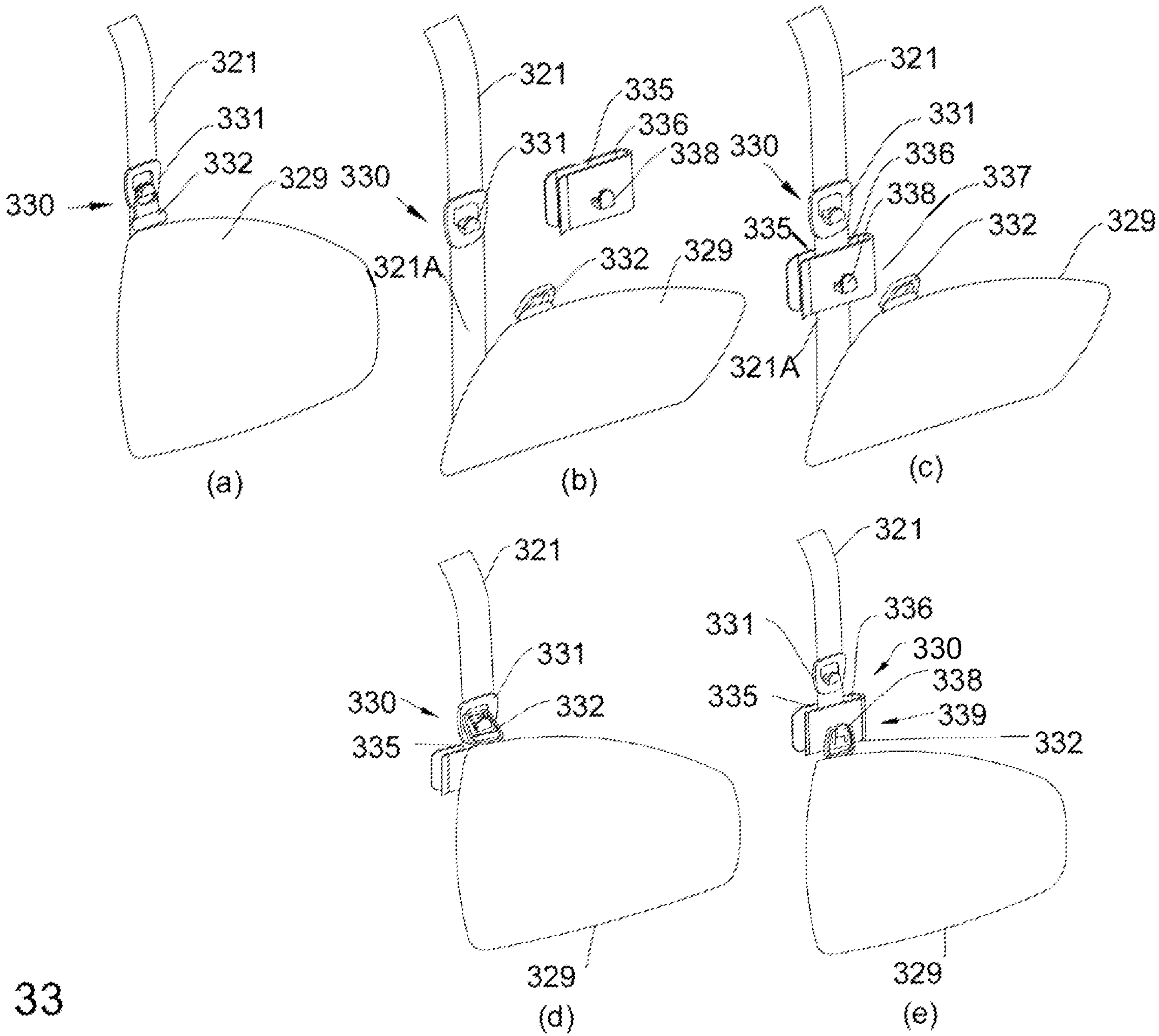


FIGURE 33

33/44

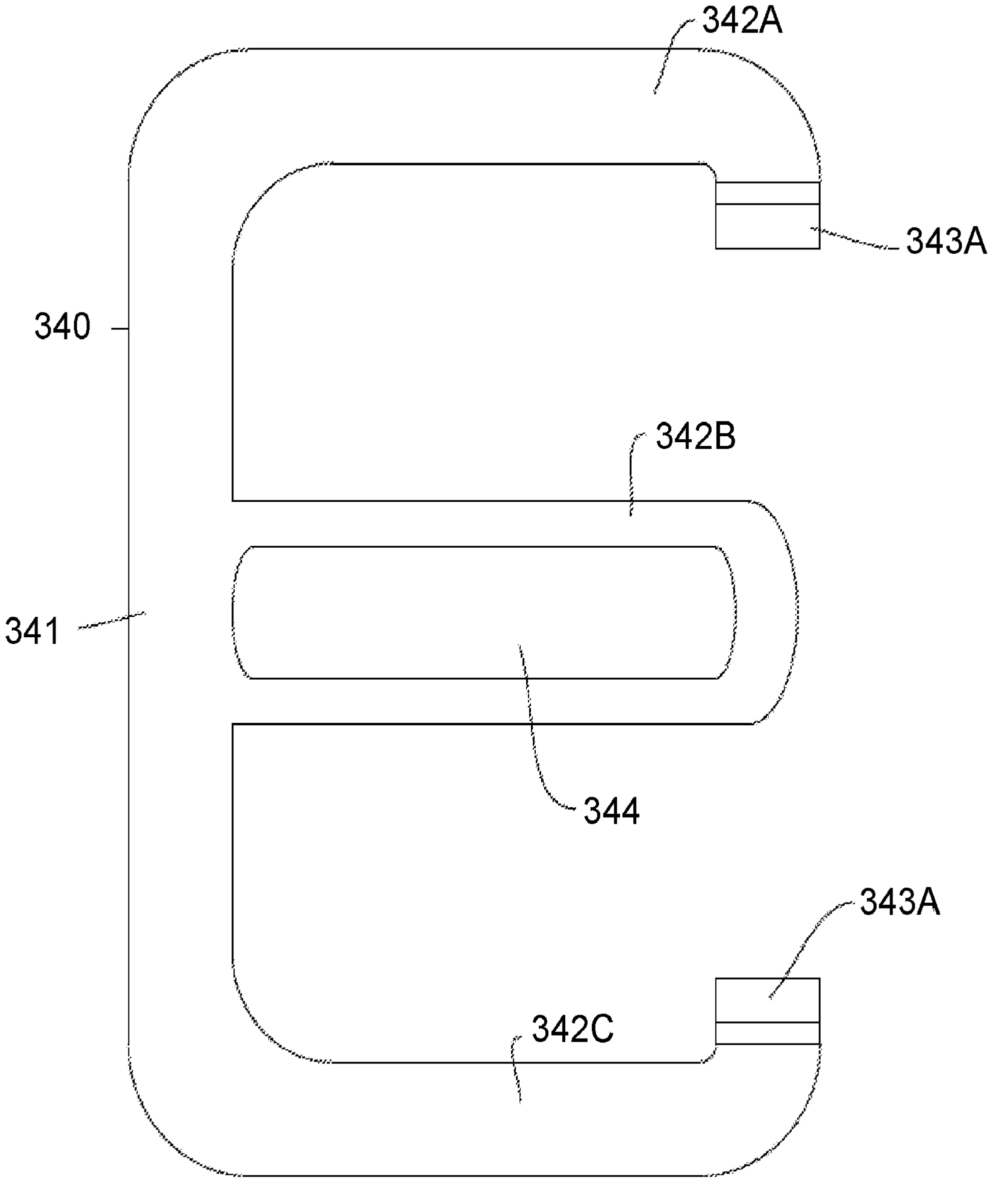


FIGURE 34

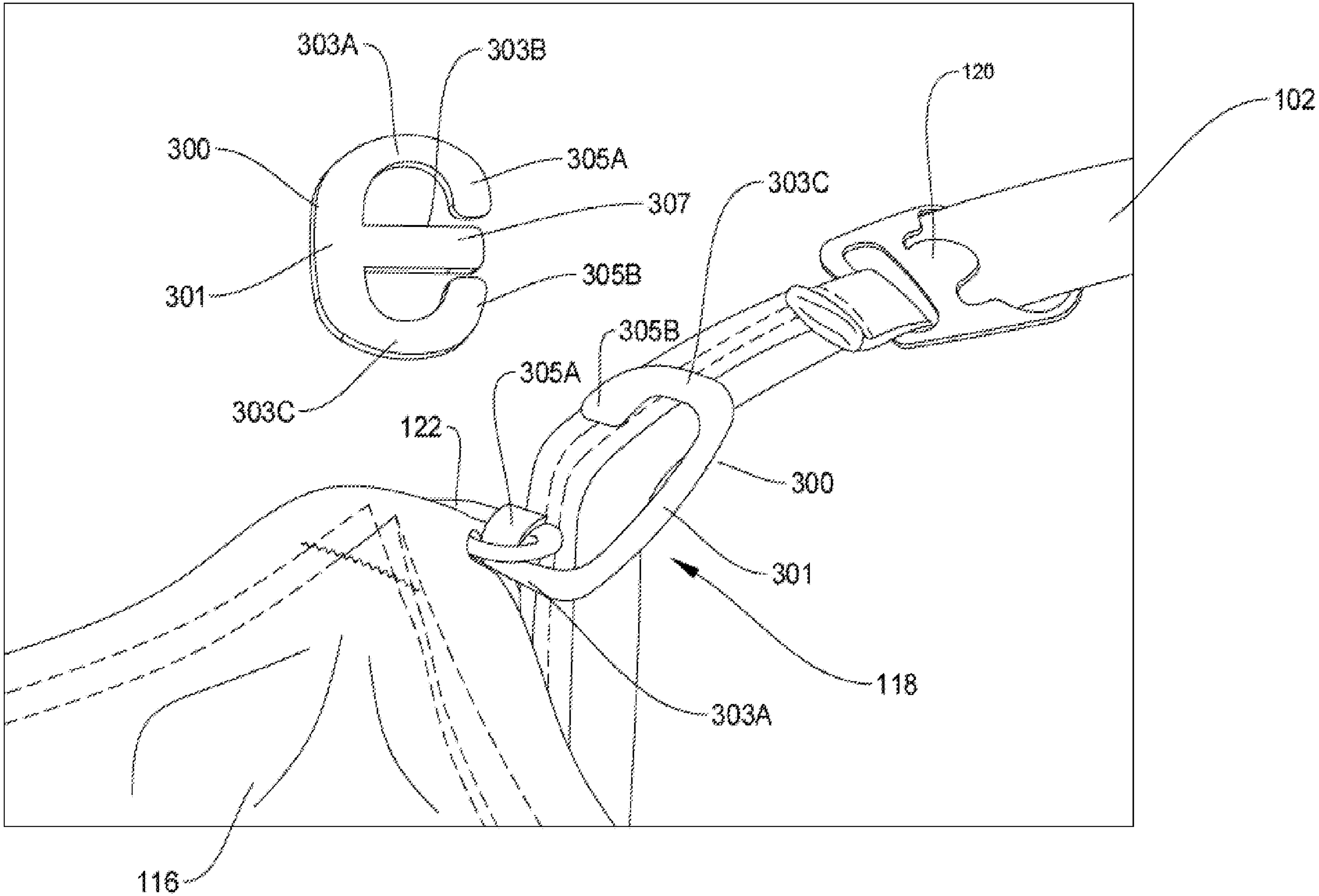

303A
303B
300
305A
307
301
305B
303C
120
102
303C
305B
305A
122
300
301
118
303A
116

FIGURE 35

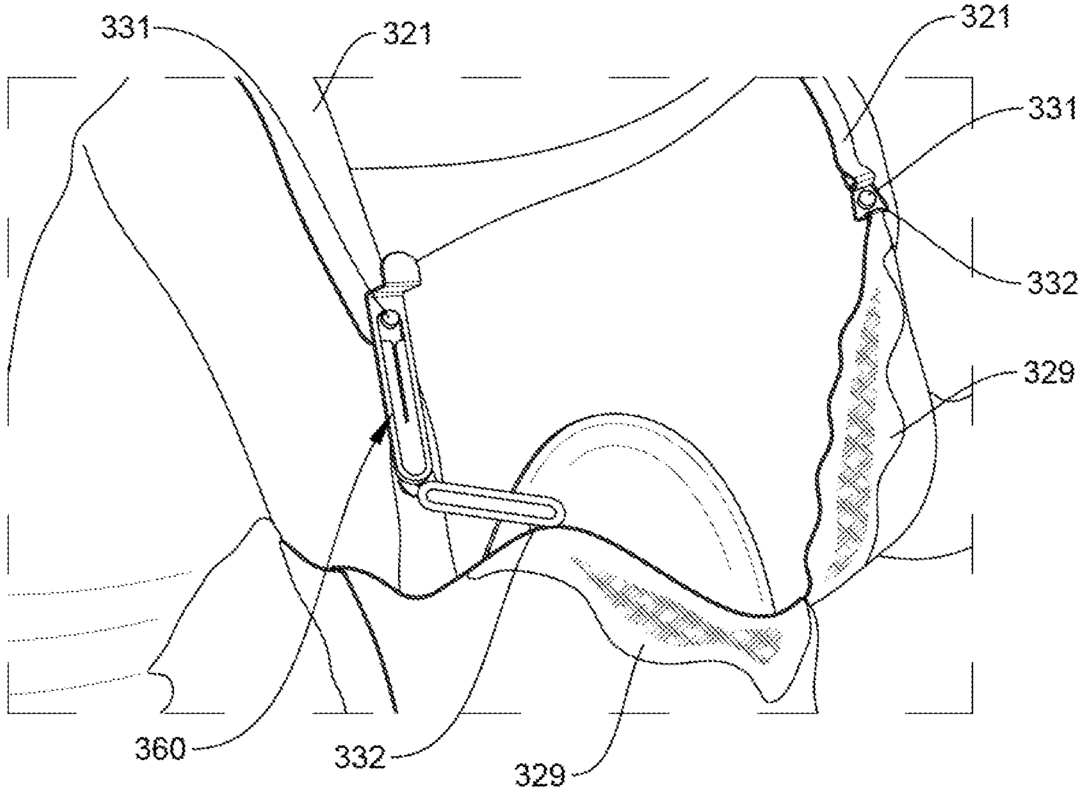


FIGURE 36

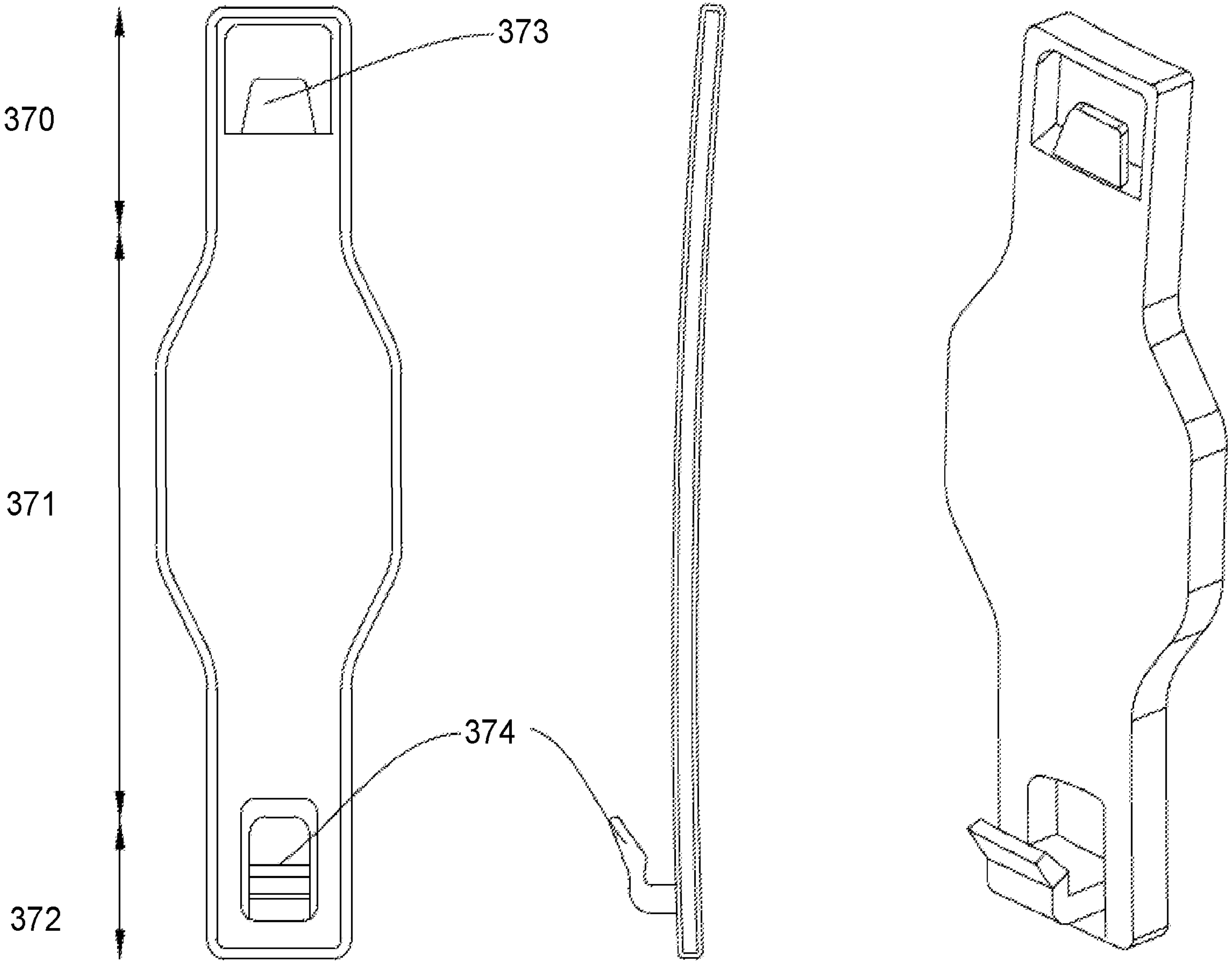


FIGURE 37

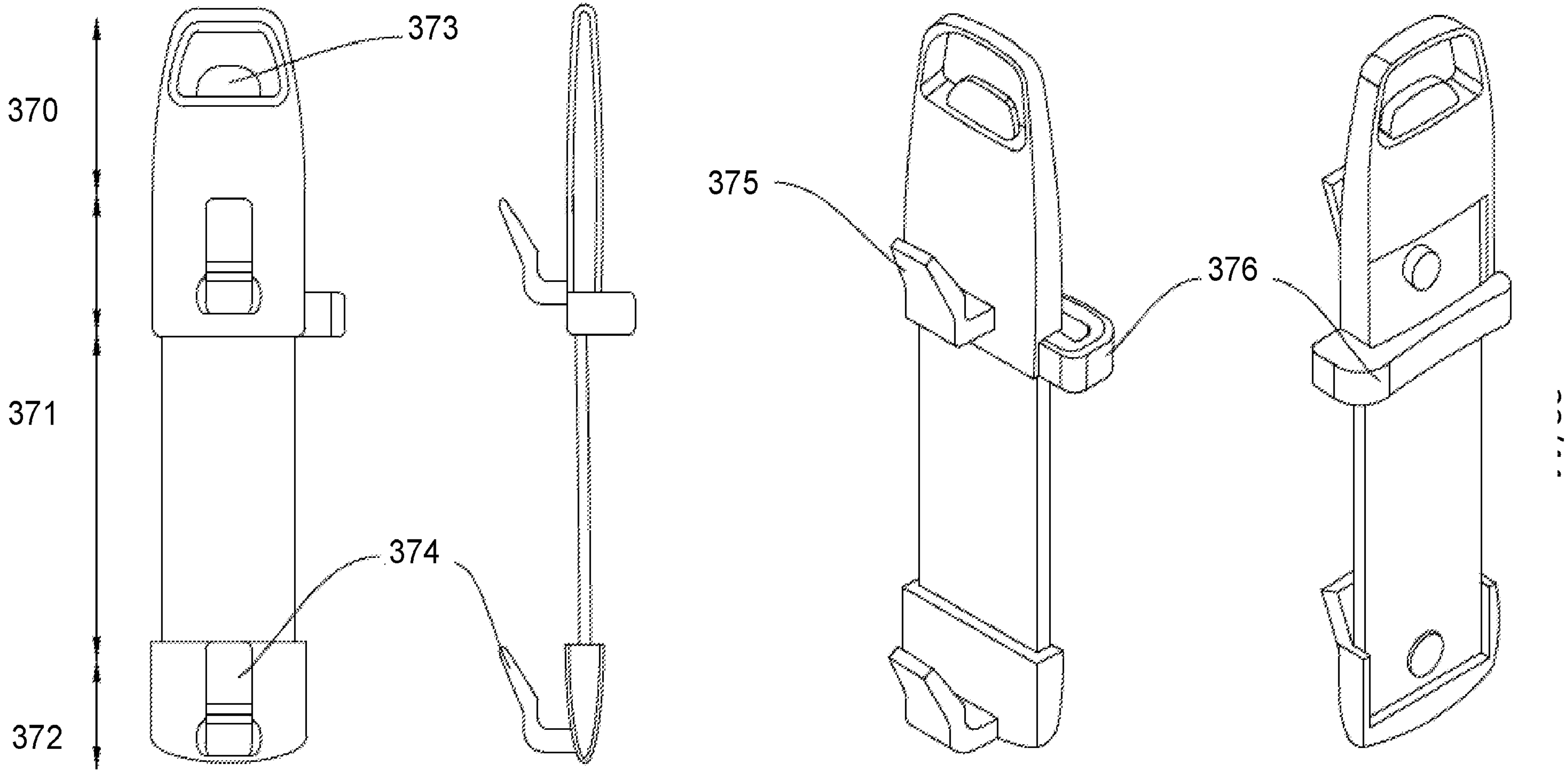


FIGURE 38

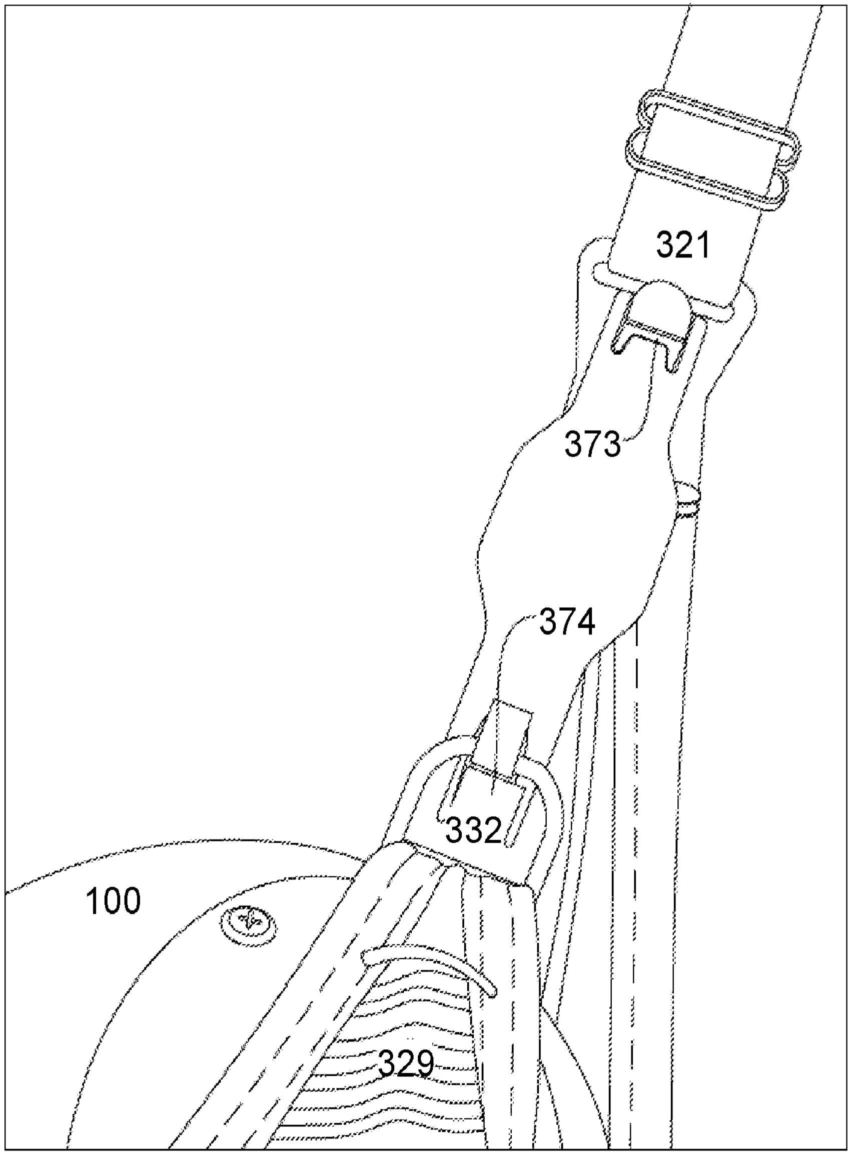


FIGURE 39

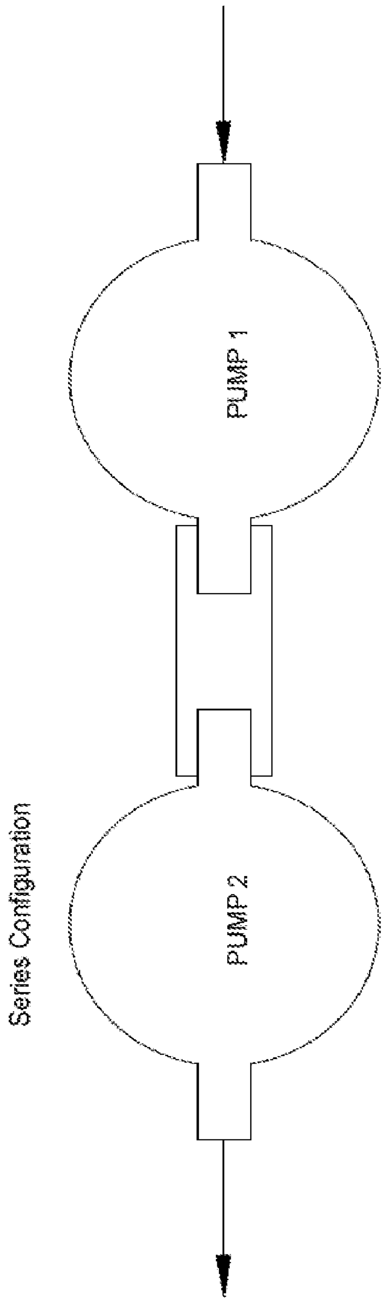


FIGURE 40

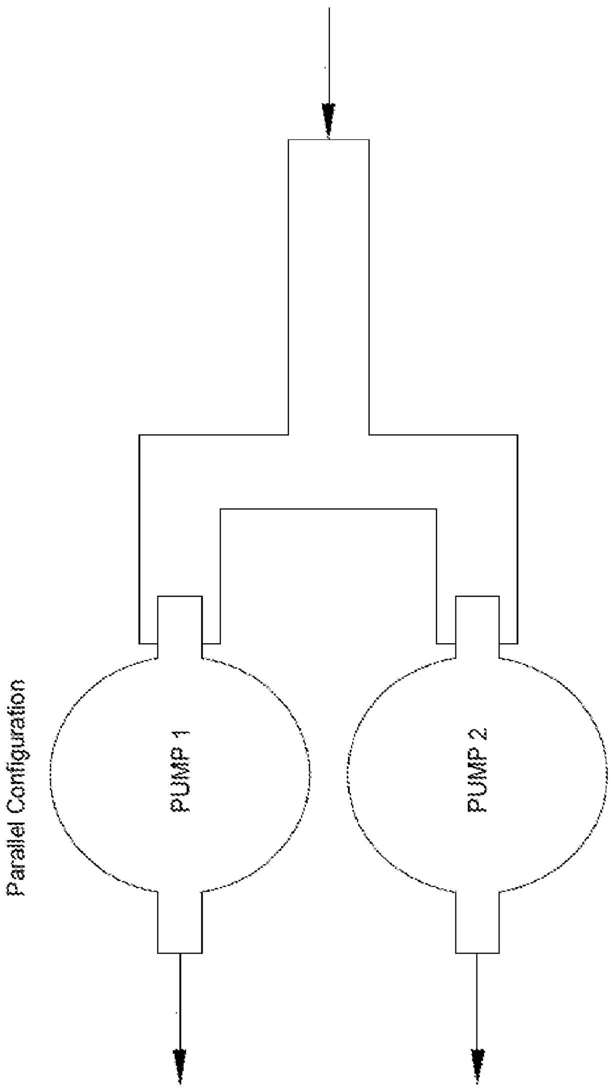
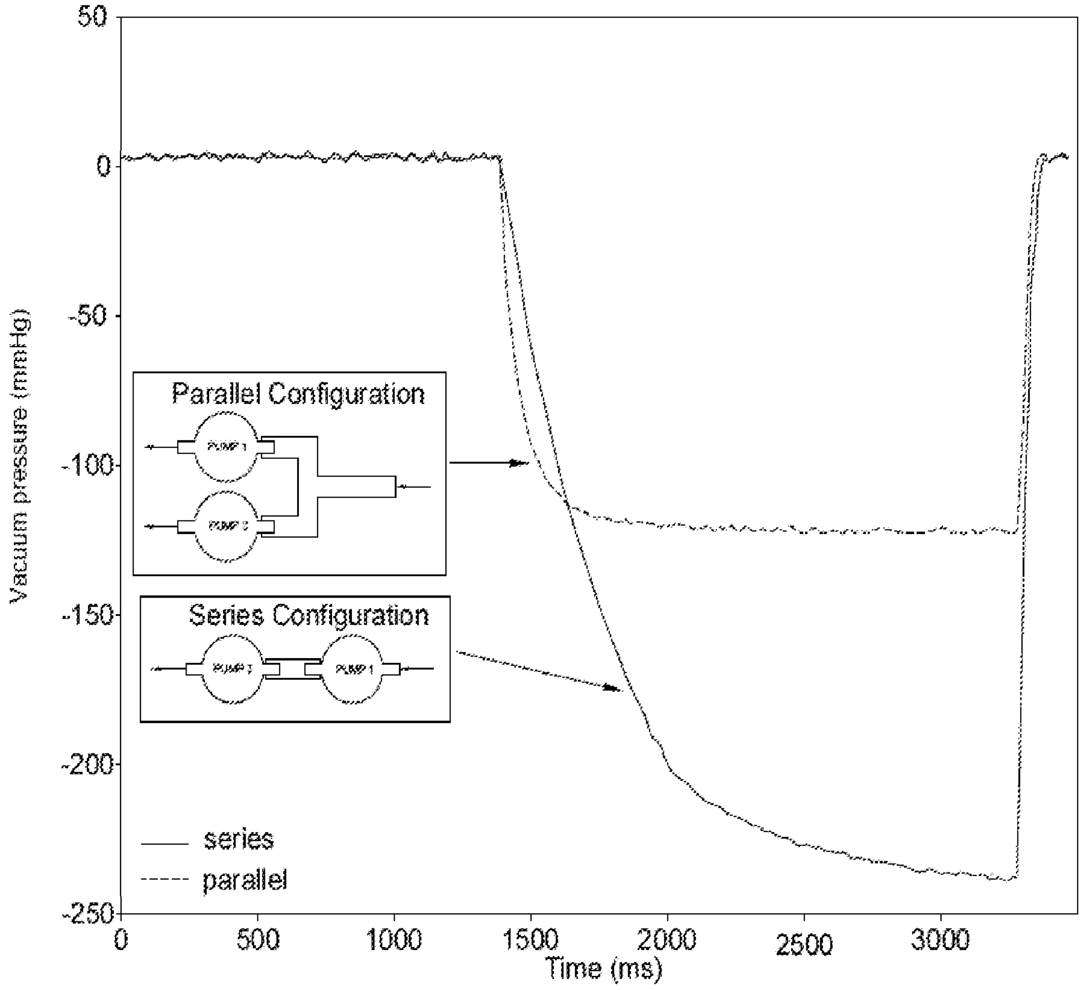
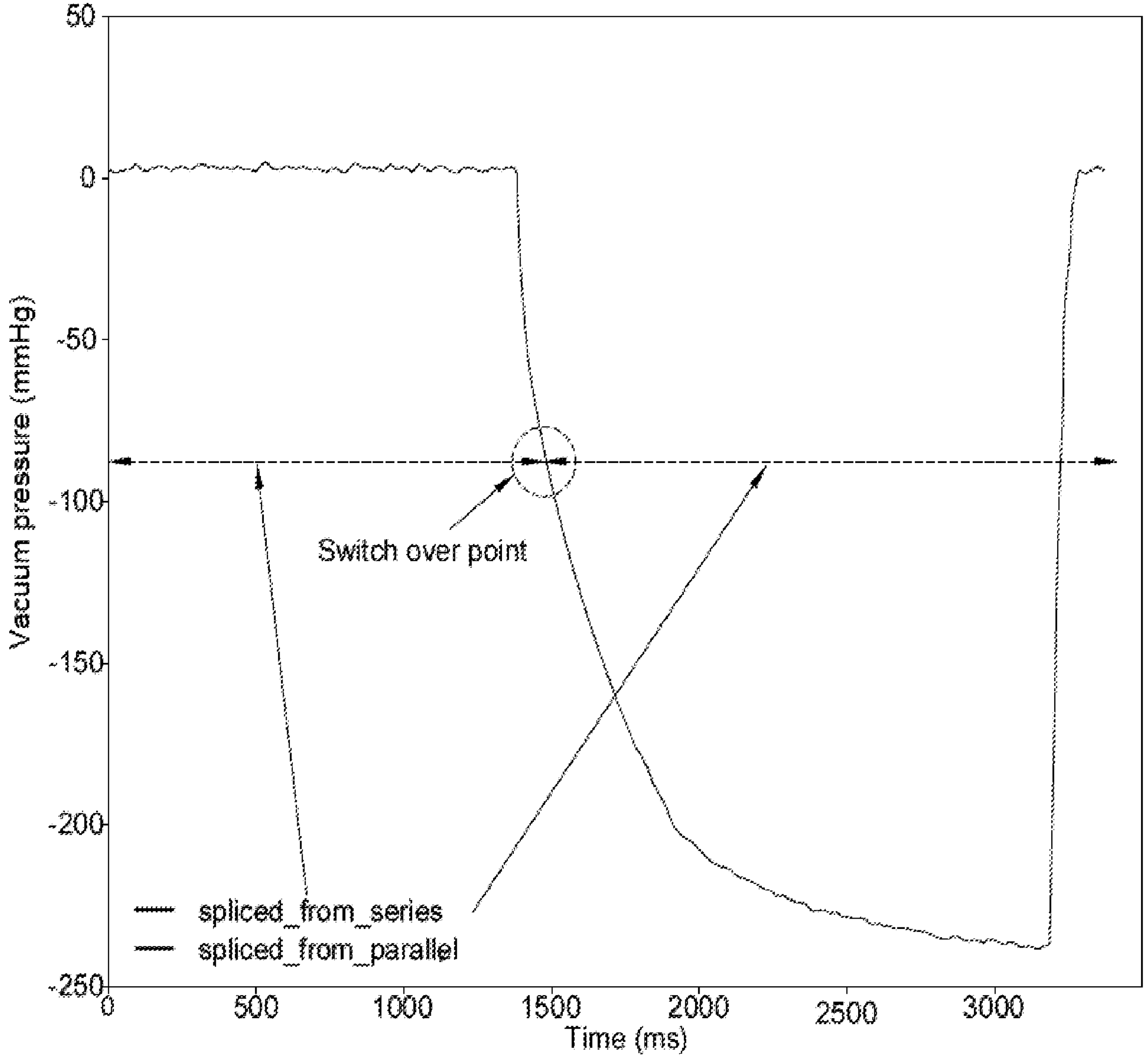


FIGURE 41



50
0
-50
-100
-150
-200
-250
Vacuum pressure (mmHg)
0
500
1000
1500
2000
2500
3000
Time (ms)
Parallel Configuration
Series Configuration
series
parallel

FIGURE 42



Vacuum pressure (mmHg)
50
0
-50
-100
-150
-200
-250
0
500
1000
1500
2000
2500
3000
Time (ms)
Switch over point
spliced_from_series
spliced_from_parallel

FIGURE 43

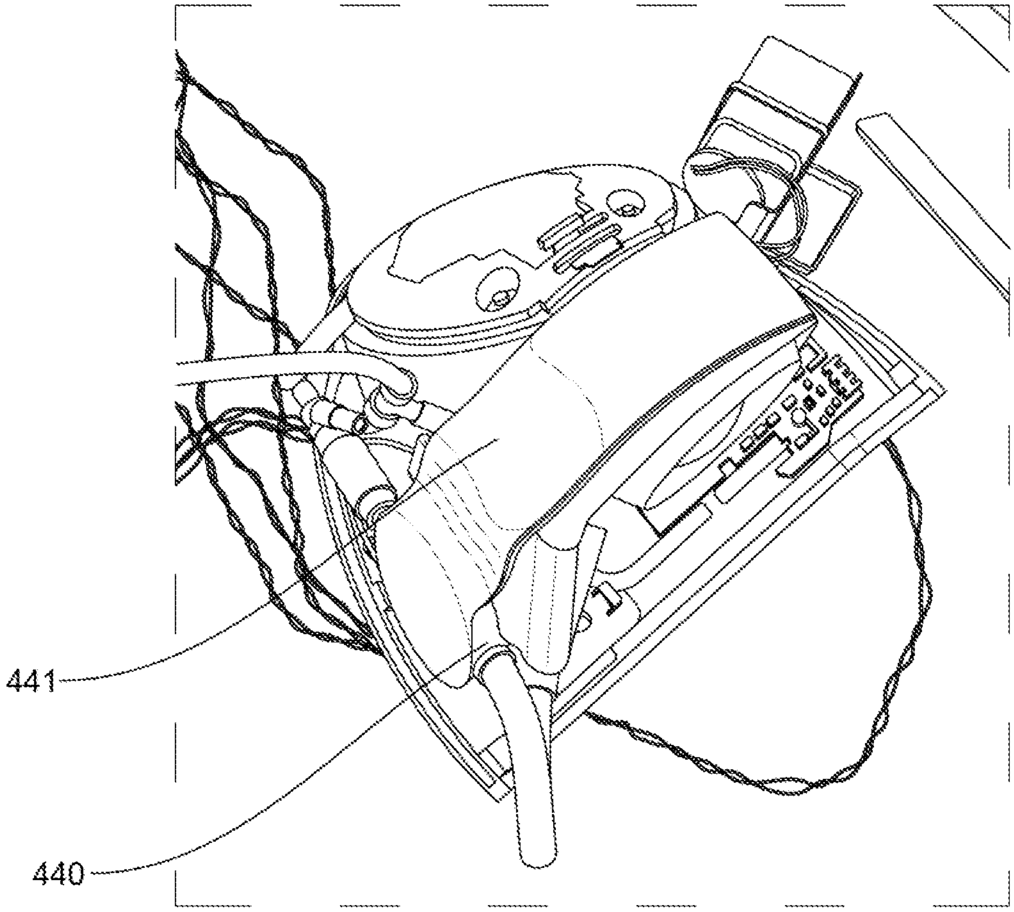


FIGURE 44

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	BREAST PUMP SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 16/009,547 filed on 15 June 2018.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Jonathan O'TOOLE Date (Optional) : ____________

Signature: ____________

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	BREAST PUMP SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 16/009,547

filed on 15 June 2018.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Adam ROLLO Date (Optional) : ____________

Signature: ____________

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	BREAST PUMP SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 16/009,547

filed on 15 June 2018.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Andrew CARR Date (Optional) : ____________

Signature: ____________

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 17203050 Document Date: 03/16/2021

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):
- USPTO employees may access SCORE content via DAV or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/203,050	03/16/2021	3783	1540	373499.00050	30	1

CONFIRMATION NO. 9649

FILING RECEIPT

OC000000124339177

78905
Saul Ewing Arnstein & Lehr LLP (Philadelphia)
Attn: Patent Docket Clerk
Centre Square West
1500 Market Street, 38th Floor
Philadelphia, PA 19102-2186

Date Mailed: 03/25/2021

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Jonathan O'TOOLE, London, UNITED KINGDOM;
Adam ROLLO, London, UNITED KINGDOM;
Andrew CARR, London, UNITED KINGDOM;

Applicant(s)

CHIARO TECHNOLOGY LIMITED, London, UNITED KINGDOM;

Power of Attorney: The patent practitioners associated with Customer Number 78905

Domestic Priority data as claimed by applicant

This application is a CON of 17/181,057 02/22/2021
which is a CON of 16/009,547 06/15/2018 PAT 10926011

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
UNITED KINGDOM 1709561.3 06/15/2017 Access Code Provided
UNITED KINGDOM 1709564.7 06/15/2017 Access Code Provided
UNITED KINGDOM 1709566.2 06/15/2017 Access Code Provided
UNITED KINGDOM 1809036.5 06/01/2018 Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 03/24/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/203,050**

Projected Publication Date: 07/01/2021

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

BREAST PUMP SYSTEM

Preliminary Class

604

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign

patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
17/203,050

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	80		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	350		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	400		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10	x 50 =	500	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 240 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			210			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	1540		TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

Digital Access Service
(DAS)

CERTIFICATE OF AVAILABILITY OF A CERTIFIED PATENT DOCUMENT IN A DIGITAL LIBRARY

The International Bureau certifies that a copy of the patent application indicated below has been available to the WIPO Digital Access Service since the date of availability indicated, and that the patent application has been available to the indicated Office(s) as of the date specified following the relevant Office code:

Document details: Country/Office: GB

Filing date: 15 Jun 2017 (15.06.2017)

Application number: 1709564.7

Date of availability of document: 27 Jul 2017 (27.07.2017)

The following Offices can retrieve this document by using the access code:
AR, AT, AU, BE, BR, CA, CL, CN, CO, DK, EA, EE, EP, ES, FI, GB, GE, IB, IL, IN, JP, KR, MA, MX, NL, NO, NZ, SE, US

Date of issue of this certificate: 26 Mar 2021 (26.03.2021)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Certified Office Copy

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with patent application GB1709564.7 filed on 15th June 2017.and as stored electronically on the Patents Electronic Case file System.

The Patents Electronic Case-file System is compliant with British Standard BS10008 - Evidential weight and legal admissibility of information stored electronically and ISO15801 - Electronic imaging – information stored electronically, recommendations for trustworthiness and reliability.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed A HAYES

Dated 19 June 2017

1200242970
1017015613 D02882
15/06/2017 150.00 DepositAccount

Intellectual Property Office

Patents Form 1
Patents Act 1977 *(Rule 12)*

Request for grant of a patent

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Application number GB 1709564.7

1.	Your reference	**MJD/P153993GB00**
2.	Full name, address and postcode of the applicant or of each applicant	**CHIARO TECHNOLOGY LIMITED Second Floor 63-66 Hatton Garden London EC1N 8LE Greater London United Kingdom**
	Patents ADP number *(if you know it)*	**11287869002**
3.	Title of the invention	**A LIQUID LEVEL MEASUREMENT SYSTEM**
4.	Name of your agent *(if you have one)*	**Boult Wade Tennant**
	"Address for service" to which all correspondence should be sent. This may be in the European Economic area or Channel Islands (see warning note below) *(including the postcode)*	**Boult Wade Tennant Verulam Gardens 70, Gray's Inn Road London WC1X 8BT United Kingdom**
	Patents ADP number *(if you know it)*	**42001**
5.	Priority declaration: Are you claiming priority from one or more earlier-filed patent applications? If so, please give details of the application(s)	

Country	Application number	Date of filing	PDAS Access Code

6.	Divisionals etc: Is this application a divisional application, or being made following resolution of an entitlement dispute about an earlier application. If so, please give the application number and filing date of the earlier application	Number of earlier UK application	Date of filing *(day / month / year)*
7.	Inventorship: (Inventors must be individuals not companies) Are all the applicants named above also inventors?	**No**	
8.	Are you paying the application fee with this form?	**Yes**	

9. Accompanying documents: please enter the number of pages of each item accompanying this form.

Continuation sheets of this form

Description: **12**

Claim*(s)*: **3**

Abstract: **n/a**

Drawing*(s)*: **4**

If you are not filing a description, please give details of the previous application you are going to rely upon

Country	Application number	Date of filing	PDAS Access Code

10. If you are also filing any of the following, state how many against each item.

Priority documents: **0**

Statement of inventorship and right to grant of a patent (Patents Form 7): **1**

Request for search (Patents Form 9A): **1**

Request for a substantive examination (Patents Form 10): **0**

Any other documents (please specify): **PDAS Registration Form**

11. I/We request the grant of a patent on the basis of this application.

Signature: **/DRAPER, Martyn John/** Date: **15 Jun 2017**

12. Name, e-mail address, telephone, fax and/or mobile number, if any, of a contact point for the applicant

DRAPER, Mr Martyn
Email: boult@boult.com
Telephone: 020 7430 7500
Fax: 020 7430 7600

Warning
After an application for a patent has been filed, the Comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you are resident in the United Kingdom and your application contains information which relates to military technology, or would be prejudicial to national security or the safety of the public, section 23 of the Patents Act 1977 prohibits you from applying for a patent abroad without first getting written permission from the Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked. Until such time or until the revocation of any direction, for any such application the address for service referred to at part 4 above must be in the United Kingdom.

Although you may have an address for service in the Channel Islands, any agent instructed to act for you must reside or have a place of business in the European Economic Area or Isle of Man.

A LIQUID LEVEL MEASUREMENT SYSTEM

BACKGROUND

The present invention relates to a sensing mechanism for detecting the level of liquid in a container. In a particular arrangement, the present invention relates to such a sensing mechanism when used along with a breast pump.

In the context of breast pumps, it is useful to measure the quantity of expressed milk. One way to do this is to have a clear container affixed to the breast pump, through which the level of expressed milk inside the container can be visibly determined. However, such visual determinations are not always possible, for example in a breast pump that collects milk while being worn inside a maternity bra.

An existing apparatus for detecting the level of liquid inside a container of a breast pump is that disclosed in US 2016/296681. In this apparatus, a sensing mechanism is provided at the top of a container, which measures droplets of liquid, specifically breast milk, entering the container. By measuring the properties of these droplets entering the container, the apparatus can determine the quantity of liquid which enters the container. In this apparatus, an accurate indication of the level of liquid in the container is reliant on the sensing mechanism being able to accurately record every droplet entering the container. Particularly at times when large flow rates of liquid enter the container, this accuracy cannot be guaranteed leading to significant cumulative errors. An accurate indication of the level of liquid in the container in this apparatus is also reliant on the sensing mechanism always being on during the pumping process, so that power consumption of the sensing mechanism is correspondingly high.

In view of the above, there is the need for an improved way to determine the level of liquid inside a container connected to a breast pump.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a breast pump comprising:

a pump module for pumping milk from a breast, the pump module being contained within a housing comprising a coupling;

a container attachable to the housing via the coupling to receive milk from the pump;

a sensing assembly within the housing and comprising at least one optical emitter operable to emit optical radiation towards the surface of the body of milk held in the container when the housing is connected to the container, and an optical receiver for receiving the reflected radiation from the surface of the milk; and

a controller electrically connected to the sensing assembly for receiving signals from the optical receiver and calculating the level of the milk inside the container based on the reflected radiation received by the optical receiver.

By determining the level of milk inside the container based on reflected radiation from the surface of the milk in the container, there is no need to monitor the individual droplets of milk entering the container, such that the sensing assembly can avoid errors associated with measuring these droplets. Furthermore, by not needing to measure these droplets, the sensing assembly from the breast pump need not always be on during the pumping process.

Preferably, the at least one optical emitter comprises at least two optical emitters. In this way, the sensing assembly from the breast pump can determine the level of milk inside the container more accurately and irrespective of the orientation of the liquid level inside the container.

Preferably, each optical emitter is equidistant from the optical receiver. In this way, the controller can more easily calculate the level of the milk inside the container based on the reflected radiation originating from each optical emitter.

Each optical emitter may be operable to emit radiation at a different wavelength, or at a different time, than the other optical emitters. In this way, the controller can more easily process the signals from the optical receiver, and more easily distinguish between the radiation emitted by each of the optical emitters.

Preferably, the optical emitter may emit radiation in the visible range of wavelengths. Alternatively it may be UV or IR light. The emitted wavelength is preferably between 10nm and 1mm.

The signals from the optical receiver preferably comprise information relating to the intensity of the radiation received by the optical receiver.

Preferably, the sensing assembly comprises at least one accelerometer electrically connected to the controller. In one embodiment, the controller may be configured to record an accelerometer parameter from the accelerometer, and determine whether the accelerometer parameter exceeds a predetermined threshold. The predetermined threshold may be indicative of an excessive acceleration, which might cause sloshing of milk inside any container connected to the breast pump.

In some cases, the coupling may be a screw thread.

Preferably, the breast pump is sized to be similar to that of a female breast. On this basis, the breast pump is preferably no longer than 20cm in any given linear direction; more preferably no longer than 18cm in any given linear direction; and even more preferably no longer than 15cm in any given linear direction.

The breast pump may contain any suitable power source, such as a battery. The power source is preferably located in the housing.

In some cases, the container may comprise a window through which optical radiation can pass, wherein when the container is connected to the housing, radiation is operable to pass between the optical emitters/receiver and the inside of the container via the window. In other cases, the container may be made entirely of a material through which the optical radiation can pass.

When the container is connected to the housing, each optical emitter and the optical receiver are preferably located adjacent to the container, to ensure reliable transmission of radiation between the device and the container.

In this case, the portion of the container adjacent to each optical emitter and the optical receiver preferably comprises a surface inside the container which comprises at least one channel and/or feature for directing milk away from each optical emitter and/or the optical receiver. In this way the formation of milk on this surface, which would cause erroneous signals from the optical receiver, can be inhibited.

To further inhibit the formation of milk in the vicinity of each optical emitter/receiver, the portion of the container adjacent to each optical emitter and the optical receiver may comprise a surface inside the container which comprises an oleophobic and/or hydrophobic coating.

Preferably, the container has a volumetric capacity of no more than 200ml. These volumetric capacities are particularly relevant when the container is a baby bottle.

It will be appreciated that the sensing assembly from the above breast pump has applications in other fields. Thus according to a second aspect of the present invention, there is provided a sensor module operable to be connected with a container for holding liquid, and suitable for use in detecting the level of liquid inside the container, the sensor module comprising:

a housing having a coupling for attachment to the top of the container;

a sensing assembly within the housing and comprising at least two optical emitters operable to emit optical radiation towards the surface of the body of liquid held in the container when the housing is connected to the container, and an optical receiver for receiving the reflected radiation from the surface of the liquid; and

a controller electrically connected to the sensing assembly for receiving signals from the optical receiver and calculating the level of the liquid inside the container based on the reflected radiation received by the optical receiver.

Existing prior art for such a sensor module is the apparatus disclosed in RU2441367. In this apparatus, the container is an industrially sized milk tank, which only includes a single laser mounted at the top of the tank. Whilst this apparatus is suited for large-sized containers, which do not move in use, the apparatus is less-suited for applications where the container moves in use, or where the liquid level inside the container is non-perpendicular to the laser beam shone into the container. In contrast, the sensor module described above can be used in a variety of different applications, is conveniently located within a housing, and which by virtue of it having at least two optical emitters, can determine the level of liquid even inside containers of irregular shapes, and which can determine the level of liquid inside a container irrespective of the orientation of the liquid level inside the container.

Although not fully recited herein, it will be appreciated that the sensor module according to the second aspect of the invention may include any or all of the optional features described in relation to the breast pump from the first aspect of the present invention.

According to a third aspect of the present invention, there is provided a collar incorporating the sensor module according to the second aspect of the invention, wherein the collar comprises a first end having the coupling, and a second end having a second coupling for attaching the collar to a lid of the container.

In the above case, the second coupling may be a screw thread.

According to fourth aspect of the present invention, there is provided a lid attachable to a container, wherein the lid comprises the sensor module according to the second aspect of the invention.

DESCRIPTION OF THE FIGURES

Figure 1A shows a sectional view of a device being used to determine the level of liquid in a container; and

Figure 1B shows a sectional view of the device and the container from Figure 1A being used at a different orientation.

Figure 2 shows a sectional view of the device and the container from Figure 1A being used whilst undergoing acceleration.

Figure 3 shows a sectional view of the device from Figure 1A being used as part of a breast pump assembly.

Figure 4 shows a sectional view of a device connected between a container and its lid, and which is operable to determine the level of liquid inside the container.

DETAILED DESCRIPTION

With reference to Figures 1A and 1B, there is shown a device 10 for use in detecting the level of liquid inside a container 100.

The device 10 is formed of a housing 12 in which is located a sensing assembly 14 comprising a series of optical emitters 16 which are angled relative to, and each located equidistant from, an optical receiver 18. In operation of the device as will be described, each optical emitter 16 is operable to emit radiation which is received by the optical receiver 18.

The optical emitters 16 and the optical receiver 18 from the sensing assembly 14 are located in a portion 20 of the device 10 which faces the container 100 when the device 10 is connected to the container 100. The portion 20 of the device 10 containing the optical emitters 16 and the optical receiver 18 comprises a window 22 of material which is transparent to optical radiation. In this way, each of the optical emitters 16 and the optical receiver 18 have a line of sight through the window 22 into the container 100 when the device 10 is connected thereto.

A controller 30 comprising a CPU 32 and a memory 34 is provided in the device 10 for controlling the operation of the sensing assembly 14. An accelerometer 36 is also provided in the housing 10, which is operatively connected to the controller 30.

Operation of the device 10 when connected to the container 100 will now be described.

In a principal mode of operation, to determine the level L of liquid inside the container 100, the controller 30 instructs the optical emitters 16 to each emit radiation towards the surface of the liquid inside the container 100 at a given intensity. The optical receiver 18 receives the reflected radiation from each optical emitter 16 via the surface of the liquid and each of these intensities is recorded by the controller.

For each operation of the sensing assembly 14, the controller 30 records the intensities of radiation emitted by each of the optical emitters 16 as intensities IE_1; $IE_{2...}IE_n$ (where n is the total number of optical emitters), and records the intensities of radiation received by the optical receiver 18 from each of the optical emitters 16 as received intensities IR_1; $IR_{2...}IR_n$.

By comparing the emitted radiation intensities IE_1; $IE_{2...}IE_n$ with the received radiation intensities IR_1; $IR_{2...}IR_n$, the controller 30 calculates a series of intensity ratios $IE_1:IR_1$; $IE_2:IR_2...IE_n:IR_{n,}$ which are then used to determine the level of the liquid inside the container. At the most basic level, if the intensity ratio of $IE_1:IR_1$ is the same as $IE_2:IR_2$,

given the optical emitters 16 are equidistant from the optical receiver 18, this indicates that the level of the liquid inside the container is parallel to the top of the bottle, as shown in Figure 1A. In contrast, if these two intensity ratios are different, this indicates that the liquid level is at a different angle, such as that shown in Figure 1B.

To accurately determine the level and the quantity of liquid inside the container 100, the controller 30 processes the recorded intensity ratios using a database located in the memory 34. The database contains an individual record for each container which is operable to connect with the device 10. Each record from the database contains a look-up table of information, which contains expected intensity ratios (IE_1:IR_1 and IE_2:IR_2) for the container 100 when filled at different orientations, and with different quantities of liquid.

By comparing the information from the look-up table with the recorded intensity ratios, the controller 30 calculates the level and quantity of liquid inside the container 100 and stores this information in the memory 34.

In situations where a container 100 to the device 10 contains no stored record in the database, the sensing assembly 14 can be used in a calibration mode to create a new record. In the calibration mode, the sensing assembly 14 is operated as the container is filled, and as it is located at different orientations. At each point during the calibration mode, the controller 30 calculates the recorded intensity ratios (IE_1:IR_1 and IE_2:IR_2) and stores them in the record relating to the container 100. For each set of recorded intensity ratios, the user includes information in the record relating to the orientation and fill level of liquid inside of the container 100.

To improve the accuracy of the results obtained by the device 10 during its use, the controller 30 when recording each intensity ratio also records a parameter from the accelerometer 36 relating to the acceleration experienced by the device 10. For each recorded acceleration parameter, the controller 30 determines whether the parameter exceeds a predetermined threshold acceleration parameter stored in the memory 34. The predetermined threshold is indicative of an excessive acceleration, which causes sloshing of liquid inside the container 100 connected to the device 10. In the event of a recorded acceleration parameter exceeding the predetermined threshold acceleration parameter, the controller 30 flags the recorded intensity ratios associated with the recorded acceleration parameter as being unreliable (due to sloshing).

Even without the use of the accelerometer 36, the controller 30 is nonetheless operable to determine whether a set of recorded intensity ratios occur during a period of excess acceleration. In this regard, for each set of intensity ratios recorded at a given time, the controller 30 checks whether any of these intensity ratios is of a predetermined order of magnitude different than the remaining recorded intensity ratios from the set. In the event that the controller 30 determines that this is the case, this indicates that the liquid inside the container has ‘sloshed’ as a result of the excess acceleration, as shown in Figure 2. In this event, the controller 30 flags the set of recorded intensity ratios as being unreliable.

It will be appreciated that instead of recording the relative intensities of radiation emitted by the optical emitters 16 with the radiation received by the optical emitter 18, the controller 30 could instead record the time taken for radiation emitted by each of the optical emitters 16 to be received by the optical receiver 18. In this arrangement, the look up table would instead contain time periods as opposed to intensity ratios.

In terms of the applications for the device 10, it will be appreciated that the device can be used in a wide variety of applications.

One possible application is the use of the device 10 to determine the level of liquid located within a container 100, such as a baby bottle, used as part of a breast pump assembly. In this arrangement, the device 10 is associated with a breast pump 200 which assists with the expression of milk from a breast. The breast pump may be located in the housing 12 of the device 10 as shown in Figure 3, or it may be realisably connected to the housing 12. Either way, the device 10 would be connectable to the container 100 such that milk expressed by the breast pump can pass from the pump via a channel 202 into the container 100.

Another application for the device 10 is as a collar for detecting the level/quantity of liquid in a container 100, such as a baby bottle, via its lid 102. An example of the device 10 being used as such a collar is shown in Figure 4. In this arrangement, the device 10 is located between the container 100 and the lid 102, and comprises a first end 42 having a first coupling 44 for attaching the collar to the lid 102. The device comprises a second end 46 having a second coupling 48 for attaching the device 10 to the container 100. In Figure 4,

the first and second couplings are shown as screw threads which engage with respective screw heads on the lid 102 and the container 100.

To allow the device 10 to pass liquid from the lid 102 to the container 100, the device comprises a channel 50 passing from the first end 42 to the second end 46.

In a further application, the device 10 may be integrated into the lid 102 of a container 100. In this application, the device 10 has a similar configuration to that shown in Figure 4, except that the first end 42 is covered and has no coupling 44.

It will be appreciated the device may be connected to a wide variety of different containers 100. In some applications, the container 100 may be a baby bottle, or a drinks bottle.

In certain applications, the container 100 connected to the device 10 may have a volumetric capacity of no more than 500ml, less than 400ml, less than 300ml, and/or less than 200ml. These volumetric capacities are particularly relevant when the container is a baby bottle/drink bottle.

It will also be appreciated that the container 100 connected to the device 10 may comprise an inside surface which comprises an oleophobic and/or hydrophobic coating. In this way, the container 100 is easy to clean between uses. When such a coating is applied to the portion of the container 100 which is adjacent to the optical emitters 16 and the optical receiver 18 from the device 10, this coating also helps prevent liquid from forming in front of these emitters/receiver, which might cause erroneous signals to be recorded by the optical receiver 18 from the sensing assembly 14.

To further reduce such erroneous signals, the portion of the container adjacent to the optical emitters and the optical receiver may comprise a surface inside the container having at least one channel and/or feature for directing liquid away from the optical emitters and/or the optical receiver.

To improve the accuracy of the sensing assembly 14, the container 100 may be made opaque to prevent ambient radiation outside the container 100 from reaching the optical receiver 18. Other possibilities to improve the accuracy to the accuracy of the sensing assembly 14 include the provision of a distinctive pattern/colour/texture on the bottom

inside surface of the container 100. In this way, the distinctive bottom inside surface can be used by the sensing assembly 14 to more easily calibrate itself to the container 100 on which the distinctive bottom inside surface is located. The distinctive bottom may also be used to help identify which container 100 the device is connected to, and thus which record should be used from the database when the device 10 is used.

To further improve the accuracy of the sensing assembly 14, the controller 30 may also be configured to use the recorded information from the accelerometer 36, in situations where the record acceleration is below the predetermined threshold acceleration parameter, to calculate a more accurate liquid level and/or quantity of liquid located inside the container which is compensated for acceleration.

In one particular arrangement, the controller 30 may poll the accelerometer 36 prior to each operation of the sensing assembly 14 to verify that the device 10 is not currently undergoing excessive acceleration. In the event of the controller 30 determining excessive acceleration in the device 10, the controller 30 would continually re-poll the accelerometer, and not operate the sensing assembly 14, until the parameter from the accelerometer is determined as being below the predetermined threshold acceleration parameter stored in the memory 34.

It will also be appreciated that for each container record stored in the database, the container record may comprise a plurality of look up tables, wherein each look up table is associated with a particular liquid used in the container, and wherein each look up table contains its own set of intensity ratios. In this way, the device 10 can more accurately determine the level/quantity of different liquids used in a particular container 100.

As described herein, the sensing assembly 14 has been described as having a plurality of optical emitters 16. It will be appreciated however that the sensing assembly could operate using a single optical emitter 16 and plurality of optical receivers 18. In this arrangement, each record from the database would contain a plurality of ratios relating to the emitted radiation from the optical emitter 16 as received by each of the optical receivers 18. In use of the device 10, the controller 30 would then similarly record the emitted radiation from the optical emitter 16 as received by each of the optical receivers 18. In an alternate arrangement, there may be provided a plurality of optical emitters 16 and a plurality of optical receivers 18, wherein each optical emitter 16 is associated with a respective optical

receiver 18. In its simplest arrangement, the sensing assembly 14 may comprise a single optical emitter 16 and a single optical receiver 18.

In certain configurations, the optical emitters 16 may together emit radiation having the same wavelength. In other configurations, the optical emitters 16 may each emit radiation having a different wavelength. In this latter configuration, the optical receiver 18 would then be able to determine which optical emitter 16 is associated with any given received radiation, based on the wavelength of the received radiation.

The optical emitters 16 may also each emit radiation at different times, such to allow the controller 30 to more easily process the signals from the optical receiver 18, and more easily distinguish between the radiation emitted by each of the optical emitters 16.

In relation to the electrical connection between the controller 30 and the sensing assembly 14, it will be appreciated this electrical connection may be either a wired/wireless connection as required.

Although not shown in the Figures, the device 10 herein described is preferably powered by a battery or some other power source located in the device 10. In other embodiments, the device 10 may be powered using mains electricity.

In one configuration, it is also envisaged that rather than the controller 30 comparing the information from the look-up table with the recorded intensity ratios to calculate the level and quantity of liquid inside the container 100, the controller 30 could instead process the recorded intensity ratios through a liquid-level equation stored in the memory 34. In this configuration, the liquid-level equation could be a generalised equation covering a family of different containers, or could be an equation specific to a container having a given shape and/or type of liquid inside.

It will also be appreciated that in some applications of the device 10, the device could be used to detect the level of a solid, as opposed to a liquid, in a container.

As used herein, the terms ‘optical emitter’ and ‘optical receiver’ are intended to cover sensors which can emit radiation in or close to the optical wavelength. Any type of radiation at or close to the optical wavelength is suitable provided that it does not have any harmful

effects. The exact wavelength is not important in the context of the invention. Such sensors thus include those which can emit visible radiation (such as radiation having wavelengths in the region of 400nm-700nm), and/or those which can emit IR radiation (such as radiation having wavelengths in the region of 700nm-1mm and/or those which can emit UV radiation (such as radiation having wavelengths in the region of 10nm to 400nm).

CLAIMS:

1. A breast pump comprising:

a pump module for pumping milk from a breast, the pump module being contained within a housing comprising a coupling;

a container attachable to the housing via the coupling to receive milk from the pump;

a sensing assembly within the housing and comprising at least one optical emitter operable to emit optical radiation towards the surface of the body of milk held in the container when the housing is connected to the container, and an optical receiver for receiving the reflected radiation from the surface of the milk; and

a controller electrically connected to the sensing assembly for receiving signals from the optical receiver and calculating the level of the milk inside the container based on the reflected radiation received by the optical receiver.

2. A breast pump according to claim 1, wherein the at least one optical emitter comprises at least two optical emitters.

3. A breast pump according to claim 2, wherein each optical emitter is equidistant from the optical receiver.

4. A breast pump according to claim 2 or 3, wherein each optical emitter is operable to emit radiation at a different wavelength, or at a different time, than the other optical emitters.

5. A breast pump according to any preceding claim, wherein each optical emitter is an IR optical emitter, and the optical receiver is an IR optical receiver.

6. A breast pump according to any preceding claim, wherein the signals from the optical receiver comprise information relating to the intensity of the radiation received by the optical receiver.

7. A breast pump according to any preceding claim, wherein the sensing assembly comprises at least one accelerometer electrically connected to the controller.

8. A breast pump according to any preceding claim, wherein the coupling is a screw thread.

9. A breast pump according to any preceding claim, wherein the breast pump is no longer than 20cm in any given linear direction.

10. A breast pump according to any preceding claim, wherein the breast pump contains a power source.

11. A breast pump according to any preceding claim, wherein the container comprises a window through which optical radiation can pass, wherein when the container is connected to the housing, radiation is operable to pass between each optical emitter/receiver and the inside of the container via the window.

12. A breast pump according to any preceding claim, wherein when the container is connected to the housing, each optical emitter and the optical receiver are located adjacent to the container.

13. A breast pump according to claim 12, wherein the portion of the container adjacent to each optical emitter and the optical receiver comprises a surface inside the container which comprises at least one channel and/or feature for directing milk away from each optical emitter and/or the optical receiver.

14. A breast pump according to claim 12 or 13, wherein the portion of the container adjacent to each optical emitter and the optical receiver comprises a surface inside the container which comprises an oleophobic and/or hydrophobic coating.

15. A breast pump according to any preceding claim, wherein the container has a volumetric capacity of no more than 200ml.

16. A sensor module operable to be connected with a container for holding liquid, and suitable for use in detecting the level of liquid inside the container, the sensor module comprising:

a housing having a coupling for attachment to the top of the container;

a sensing assembly within the housing and comprising at least two optical emitters operable to emit optical radiation towards the surface of the body of liquid held in the container when the housing is connected to the container, and an optical receiver for receiving the reflected radiation from the surface of the liquid; and

a controller electrically connected to the sensing assembly for receiving signals from the optical receiver and calculating the level of the liquid inside the container based on the reflected radiation received by the optical receiver.

17. A collar incorporating the sensor module according to claim 16, wherein the collar comprises a first end having the coupling, and a second end having a second coupling for attaching the collar to a lid of the container.

18. A collar according to claim 17, wherein the second coupling is a screw thread.

19. A lid attachable to a container, wherein the lid comprises the sensor module according to claim 16.

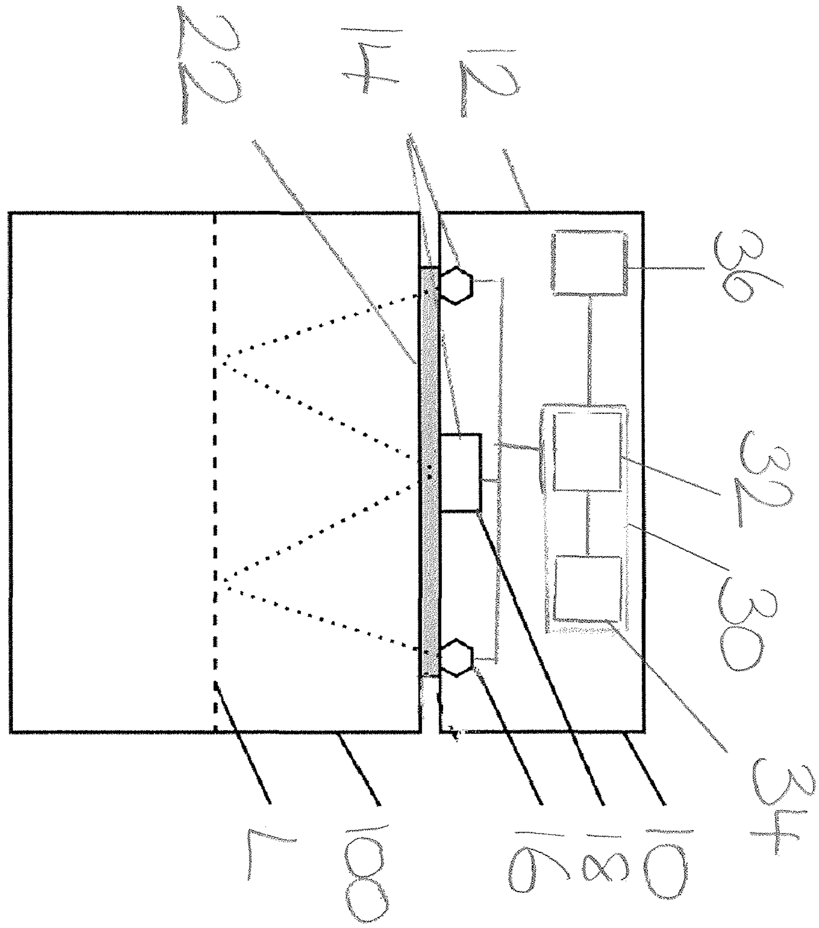


FIG 1A

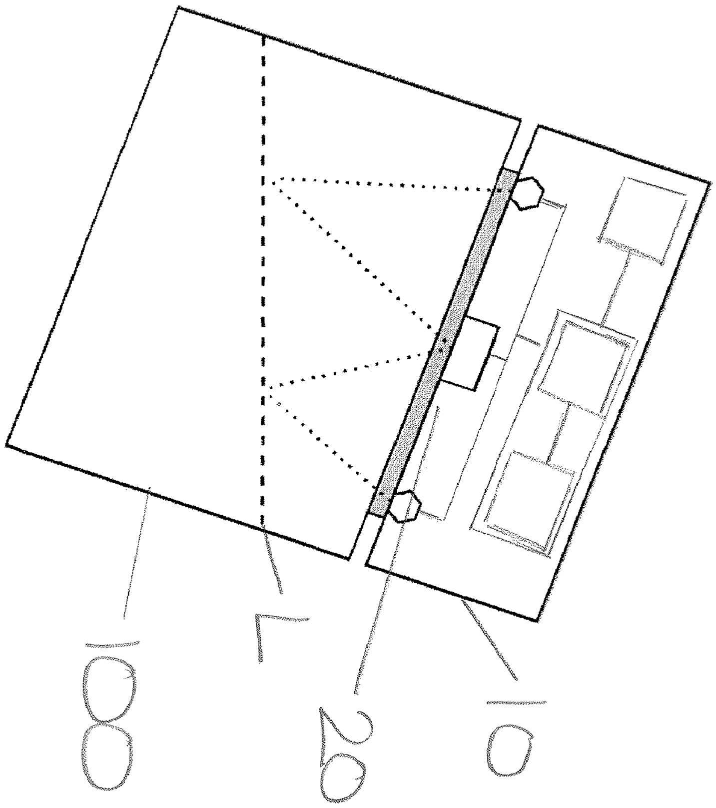


FIG 1B

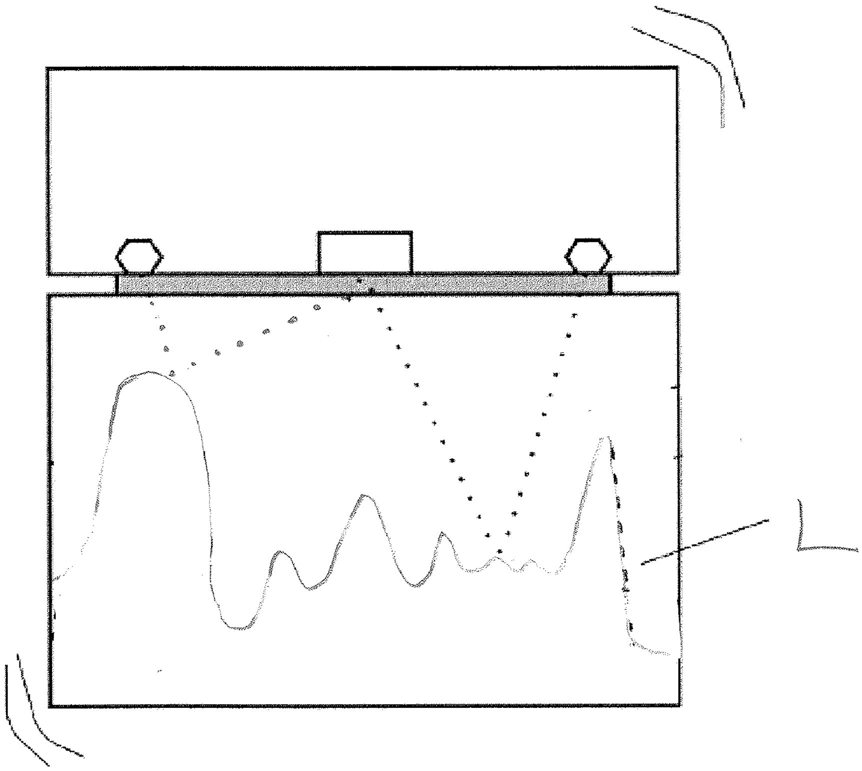


FIG 2

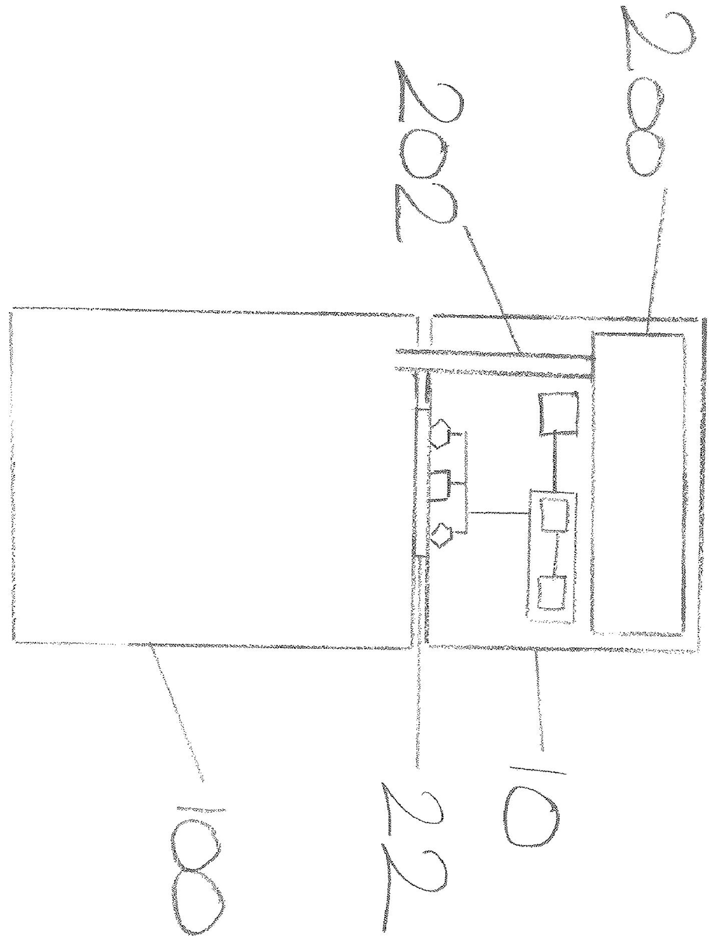


FIG 3

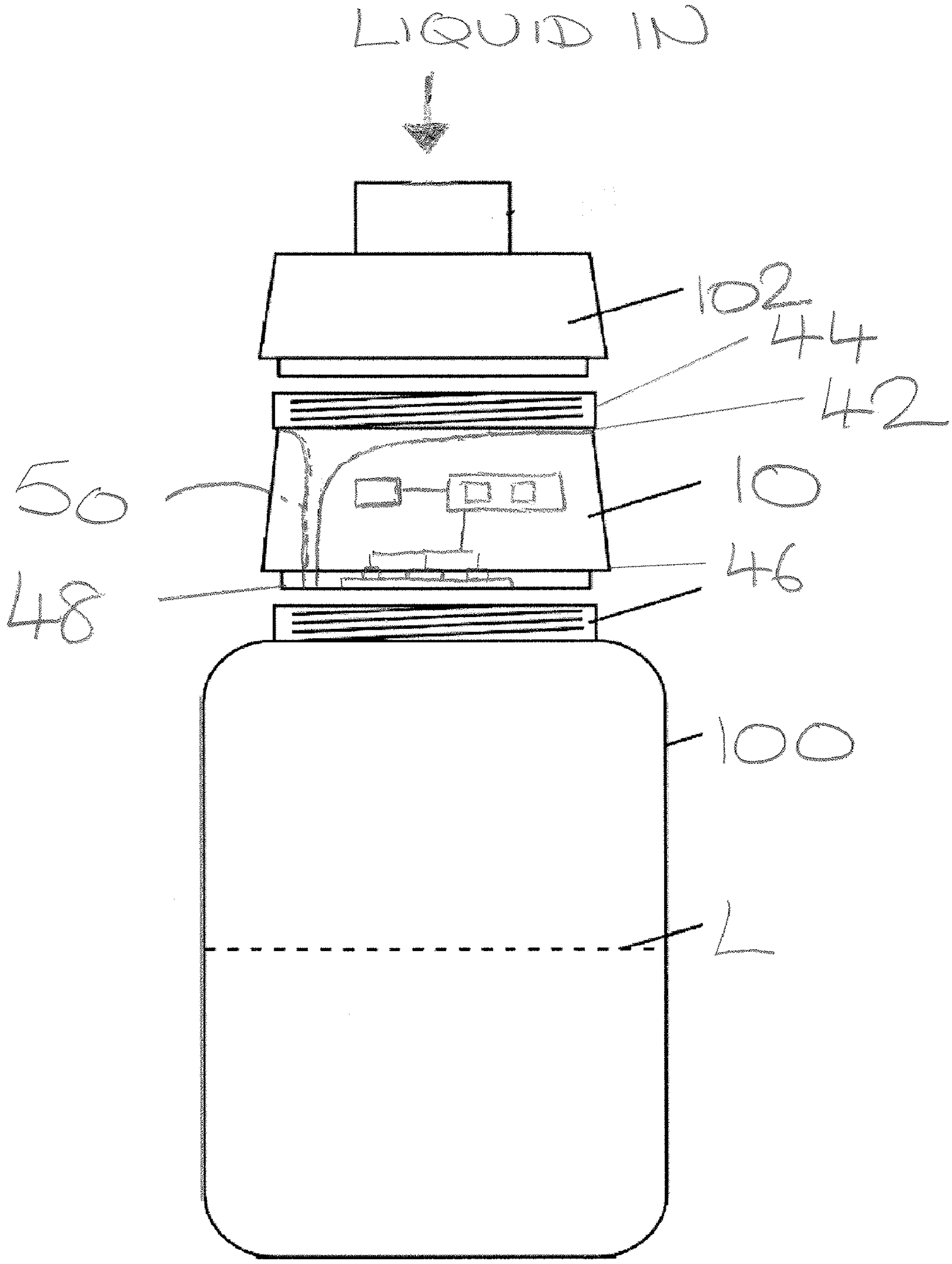


FIG 4.

Digital Access Service
(DAS)

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

CERTIFICATE OF AVAILABILITY OF A CERTIFIED PATENT DOCUMENT IN A DIGITAL LIBRARY

The International Bureau certifies that a copy of the patent application indicated below has been available to the WIPO Digital Access Service since the date of availability indicated, and that the patent application has been available to the indicated Office(s) as of the date specified following the relevant Office code:

Document details:	Country/Office:	GB
	Filing date:	15 Jun 2017 (15.06.2017)
	Application number:	1709561.3

Date of availability of document: 27 Jul 2017 (27.07.2017)

The following Offices can retrieve this document by using the access code:
AR, AT, AU, BE, BR, CA, CL, CN, CO, DK, EA, EE, EP, ES, FI, GB, GE, IB, IL, IN, JP, KR, MA, MX, NL, NO, NZ, SE, US

Date of issue of this certificate: 26 Mar 2021 (26.03.2021)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Certified Office Copy

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with patent application GB1709561.3 filed on 15th June 2017.and as stored electronically on the Patents Electronic Case file System.

The Patents Electronic Case-file System is compliant with British Standard BS10008 - Evidential weight and legal admissibility of information stored electronically and ISO15801 - Electronic imaging – information stored electronically, recommendations for trustworthiness and reliability.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed A HAYES

Dated 19 June 2017

1200242967
1017015610 D02882
15/06/2017 150.00 DepositAccount

Intellectual Property Office

Patents Form 1
Patents Act 1977 *(Rule 12)*

Request for grant of a patent

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Application number GB 1709561.3

1.	Your reference	**MJD/P153994GB00**
2.	Full name, address and postcode of the applicant or of each applicant	**CHIARO TECHNOLOGY LIMITED** **Second Floor 63-66 Hatton Garden** **London EC1N 8LE** **Greater London** **United Kingdom**
	Patents ADP number *(if you know it)*	**11287869002**
3.	Title of the invention	**BRA CLIP**
4.	Name of your agent *(if you have one)*	**Boult Wade Tennant**
	"Address for service" to which all correspondence should be sent. This may be in the European Economic area or Channel Islands (see warning note below) *(including the postcode)*	**Boult Wade Tennant** **Verulam Gardens** **70, Gray's Inn Road** **London WC1X 8BT** **United Kingdom**
	Patents ADP number *(if you know it)*	**42001**
5.	Priority declaration: Are you claiming priority from one or more earlier-filed patent applications? If so, please give details of the application(s)	

Country	Application number	Date of filing	PDAS Access Code

6.	Divisionals etc: Is this application a divisional application, or being made following resolution of an entitlement dispute about an earlier application. If so, please give the application number and filing date of the earlier application	Number of earlier UK application	Date of filing *(day / month / year)*
7.	Inventorship: (Inventors must be individuals not companies) Are all the applicants named above also inventors?	**No**	
8.	Are you paying the application fee with this form?	**Yes**	

9. Accompanying documents: please enter the number of pages of each item accompanying this form.

Continuation sheets of this form

Description: **9**

Claim*(s)*: **3**

Abstract: **n/a**

Drawing*(s)*: **7**

If you are not filing a description, please give details of the previous application you are going to rely upon

Country	Application number	Date of filing	PDAS Access Code

10. If you are also filing any of the following, state how many against each item.

Priority documents: **0**

Statement of inventorship and right to grant of a patent (Patents Form 7): **1**

Request for search (Patents Form 9A): **1**

Request for a substantive examination (Patents Form 10): **0**

Any other documents (please specify): **PDAS Registration Form**

11. I/We request the grant of a patent on the basis of this application.

Signature: **/DRAPER, Martyn John/** Date: **15 Jun 2017**

12. Name, e-mail address, telephone, fax and/or mobile number, if any, of a contact point for the applicant

DRAPER, Mr Martyn
Email: boult@boult.com
Telephone: 020 7430 7500
Fax: 020 7430 7600

Warning
After an application for a patent has been filed, the Comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you are resident in the United Kingdom and your application contains information which relates to military technology, or would be prejudicial to national security or the safety of the public, section 23 of the Patents Act 1977 prohibits you from applying for a patent abroad without first getting written permission from the Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked. Until such time or until the revocation of any direction, for any such application the address for service referred to at part 4 above must be in the United Kingdom.

Although you may have an address for service in the Channel Islands, any agent instructed to act for you must reside or have a place of business in the European Economic Area or Isle of Man.

BRA CLIP

BACKGROUND

Many specialised bras (or brassieres) exist for maternity that facilitate nursing and/or breast pumping for milk collection without the need to remove the bra itself. In a traditional nursing bra, this is achieved with the use of an at least partially detachable cup, which can be unhooked for feeding and/or pumping.

Further specialised bras are known which are provided with cut-out portions or slits which substantially align with the wearer's areola and nipple. Traditional breast pumps comprise an elongate breast shield which extends away from the breast towards an external bottle and source of suction. The breast shield is arranged to extend through the cut-out portion or slit, with the collection bottle and pumping apparatus connected thereto outside of the bra. These require the user to remove or unbutton any over-garments, and are uncomfortable for use when not pumping.

Integrated wearable breast pumps have begun to enter the market, such as US 2016 206794 A1. In such pumps, the suction source, power supply and milk container are locally provided, without the need for bulky external components or connections. Such devices can be provided with a substantially breast shaped profile so as to fit within a user's bra for discrete pumping, as well as pumping on-the-go without any tethers to electrical sockets or collection stations.

In US 2016 206794 A1, the applicant has appreciated that the added size of the breast pump means that the combination of the user's breast and the breast pump may no longer fit within the user's regular bra. This is particularly relevant as over-compression of the user's breast will result in the closing of the user's milk ducts and hence reduced expression. To address this, the breast pump of US 2016 206794 A1 has an offset shape favouring the lower half of the pump, and requires complex collapsible bag systems as milk collection devices. This is to force the pump to fit within the user's existing bras. This works by breast milk leaving the breast and enters the bag, and the breast shrinking in a corresponding volume to the expansion of the bag. The inventors consider that this is unlikely to be a perfect 1 to 1 transfer of volume, and hence the compression on the breast may increase as the collapsible bags fill.

In addition to these systems being particularly complex and wasteful, a relatively smaller bag must be used. In US 2016 206794, approximately 110 ml (4 fluid ounces) of milk can be collected before the bag must be changed. While this may be sufficient for some users, others may produce much more milk in a session. Additionally, even this small increase in cup size may make bras less comfortable for the user.

It is our understanding that in the product which has been brought to market based on the disclosure of US 2016 206794 does increase the effective cup size of the wearer by around 2 cup sizes based upon European standard EN 13402 which is discussed later.

Maternity (or nursing) bras such as disclosed in US 4,390,024 A have partially detachable cups, with a plurality of attaching means provided along the bra strap for attaching the cups to the strap. The cup can then be attached to different points in order to adjust the support provided. However, these attachment points are fixed. Additionally, this bra has been designed to accommodate the change in breast size before and after the feeding/pumping process. It is not designed to accommodate a breast pump.

Accordingly, there is a need for a better system to accommodate integrated wearable breast pumps.

SUMMARY OF THE INVENTION

A maternity bra system is provided according to the present invention comprising: a maternity bra comprising: a support structure comprising shoulder straps and a bra band; and a first and a second cup each attached to the support structure to provide a first cup size, at least one cup being at least partially detachable from the support structure at an attachment point, the system further comprising: a clip comprising a first engagement mechanism and at least one second engagement mechanism(s), the clip being attachable in a releasable manner to the support structure at a first position via the first engagement mechanism and attachable in a releasable manner to one of the partially detachable cups via the second engagement mechanism to provide a second cup size different to the first cup size.

This system allows a user to quickly and simply adjust the cup size of a maternity bra to allow discrete and comfortable insertion and use of an integrated wearable breast pump. As such, the user does not need a specialised adjustable bra; instead the present

system works with all conventional maternity bras. The user also does not have to purchase any larger bras to wear while pumping.

The clip may be configured to be attached to the support structure at a position away from the attachment point. This results in the original attachment point being usable, with the clip providing an alternative attachment point for the adjusted cup size.

The clip may be attachable to the support structure at a plurality of non-discrete positions. This ensures essentially infinite adjustment of the clip position such that the perfect position for the user can be found.

The clip may be extendable between an unextended and an extended state, and attaches to the support structure at the attachment point; the first cup size is providable when the at least partially detachable cup is attached to the clip when the clip is an unextended state; the second cup size is providable when the at least partially detachable cup is attached to the clip when the clip is in an extended state.

An extendable clip like this allows quick switching between the two states in use.

Preferably, the attachment point is on at least one of the shoulder straps. Again this matches the standard system used in most maternity bras.

A clip is provided for use in the system described above according to the present invention. The clip comprising first and section engagement mechanisms and being releasably attachable to a support structure of a maternity bra with the first engagement mechanism and an at least partially detachable cup of a maternity bra with the second engagement mechanism to provide a second cup size which is different to a first cup size providable when the cup is attached to the support structure of the bra at an attachment point.

In a preferred embodiment, the first engagement mechanism engages with the support structure in a first direction and the second engagement mechanism engages with the cup in a second direction transverse to the first direction. This increases ease of attachment as with this structure the sideways engagement of the clip to the support

structure ensures that the second attachment mechanism is correctly orientated for the cup.

The second engagement mechanism may be one or more of a hook or a snap or a clip. This ensures easy interfacing with the traditional hook and clasp systems already provided on maternity bras.

Preferably the clip further comprises two distinct second engagement mechanisms which can be used interchangeably dependent upon the orientation of the clip. This makes the clip easier to use as it can be quickly switched between each bra strap, and the user does not have to worry which way up to put the clip on.

Preferably, the clip comprises a material pathway with an opening for receiving a portion of the support structure as the first engagement mechanism for securing the clip to the bra. This ensures a quick and simple method for attaching the clip to the bra. In particular, the clip may substantially U-shaped, and the material pathway is between the arms of the U.

Preferably, the clip comprises three prongs extending from a central support, the three prongs arranged as a central prong and two outer prongs so as to receive the support structure on one side of the central prong and on the opposite side of each respective outer prong, at least one prong being provided with the second engagement mechanism. This ensures a strong attachment to the bra and a simple design.

Preferably, both outer prongs are each provided with a respective second engagement mechanism. This ensures that the clip is reversible for easier attachment to the bra.

A method of adjusting the cup size of a maternity bra is provided according to the present invention, comprising: providing a maternity bra comprising: a support structure comprising shoulder straps and a bra band; and a first and second cup each attached to the support structure to provide a first cup size, the at least one cup being detachable from the support structure at an attachment point, providing a clip comprising first and section engagement mechanisms, attaching the first engagement mechanism of the clip in a releasable manner to a first position of the support structure of the maternity bra, attaching one of the detachable cup to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size.

This clip and method allow a user to quickly and simply adjust the cup size of a maternity bra to allow discrete and comfortable insertion and use of an integrated wearable breast pump.

Preferably, the method further comprises the step of inserting a breast pump into the detachable cup. The adjustment of the size of the bra allows the bra to support the breast pump against the user's breast for comfort and ease.

Preferably, the method further comprises the steps of: detaching the first engagement mechanism of the clip from the first position support structure of the maternity bra; attaching the first engagement mechanism of the clip in a releasable manner to a second position of the support structure of the maternity bra; and attaching the other of the detachable cups to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size. This allows the user to use a single clip on either of the cups.

DESCRIPTION OF THE FIGURES

The following invention will be described with reference to the following Figures in which:

Figure 1 depicts a prior art design for a maternity bra;

Figures 2A and 2B depict a clip and clasp according to the present invention;

Figures 3A, 3B and 3C depict the clip of Figures 2A and 2B being fitted to a maternity bra according to the present invention;

Figures 4A and 4B depict adjustment of the maternity bra of Figures 3A, 3B and 3C according to the present invention;

Figure 5 depicts an alternative clip for adjustment of a maternity bra according to the present invention;

Figure 6 depicts the alternative clip of Figure 5; and

Figure 7 depicts an alternative clip for adjustment of a maternity bra according to the present invention.

DETAILED DESCRIPTION

As shown in Figure 1, a typical maternity bra 100 comprises a support structure made up of shoulder straps 102 which support the bra 100 on the wearer's shoulders, and a bra band 104 for extending around a user's ribcage, comprising two wings 106 and a

central panel or bridge 108. The straps 102 are typically provided with adjustment mechanisms 103 for varying the length of the straps 102 to fit the bra 100 to the wearer.

At the outermost end of each wing, an attachment region 110 is provided. Typically, hooks 112 and loops 114 are provided for securing the bra 100 at the user's back. However, any other suitable attachment mechanism may be used. Alternatively, the attachment region 110 may be provided at the front of the bra 100 in the bridge region 108, with a continuous wing 106 extending continuously around the wearer's back. Typically, a number of sets of loops 114 are provided to allow for variation in the tightness of the bra 100 on the wearer.

While shown as having a separation in Figure 1, the wings 106 and bridge 108 may form a single continuous piece in certain designs. Likewise, while shown with a distinct separation in Figure 1, the shoulder straps 102 and the wings 106 may likewise form a single continuous piece.

The maternity bra 100 is further provided with two breast-supporting cups 116 attached to the support structure. The cups 116 define a cup size, which defines the difference in protrusion of the cups 116 from the band 104. The European standard EN 13402 for Cup Sizing defines cup sizes based upon the bust girth and the underbust girth of the wearer and ranges from AA to Z, with each letter increment denoting a 2 cm difference between the protrusion of the cups 116 from the band 104. Some manufacturers do vary from these conventions in denomination, and some maternity bras are measured in sizes of S, M, L, XL, etc.

The cups 116 may be stitched to the bra band 102. At least one of the cups 116, is in detachable attachment with the corresponding strap 102. In particular, this is achieved at attachment point 118 where a hook 120 attached to the bra strap 102 engages with a clasp 122 attached to the cup 116. The hook 120 and the bra strap adjuster 103 are set such that in the closed position, the cup size of the bra 100 fits the wearer's breasts. In Figure 1, the left cup 116 is shown attached to its attachment point 118, which the right cup 116 is unattached. In this manner, the wearer is able to detach the cup 116 to expose their breast for feeding or for breast pumping. Once this is completed, the cup 116 is reattached and the maternity bra 100 continues to function as a normal bra.

While in the depicted embodiments, a hook 120 is shown on the bra strap 102 and a clasp 122 is shown on the cup 116, it is appreciated that the provision of these may be reversed, or that alternative attachment mechanisms may be used.

In other embodiments, the detachable attachment point 118 may be provided at a different location, such as at the attachment between the bra band 104 and the cup 116. The mechanism for such an attachment point is the same as described above.

Figure 2A and 2B depict a clip 200 according to the present invention, along with a clasp 122 shown in isolation from the bra cup 116 it is normally attached to. The clip 200 is provided with a material pathway 203 which receives a portion of the bra strap 102. In the particular embodiment of these Figures, the clip 200 is substantially U-shaped, with a narrowing profile towards its open end 202. However, it is appreciated that any other suitable shape with a material pathway may be used, such as an S-shape or E-shape. The clip 200 is designed to be attached to the bra strap 102 in a releasable manner, with the slot 203 acting as a support engaging mechanism. The releasable manner means that the clip 200 may be simply removed from the bra 100 without causing any damage to the functioning of the bra 100. To enhance the ease of attachment, the clip 200 may be provided with outwardly extending wings 204 which help direct the bra strap 102 into the clip 200. The clip 200 is further provided with a hook 220 acting as a cup engaging mechanism which can engage with the clasp 122.

Figures 3A, 3B and 3C show the clip 200 being attached to a bra strap 102 in order to provide a second attachment point 228 for the clasp 122 to attach to, and hence to provide a second cup size for the bra 100. In this particular embodiment, the clip 200 is attached in a portion of strap 102A below the original attachment point 118 and hence the second attachment point 228 is likewise below the original attachment point. This results in a second cup size larger than the first cup size. In preferred embodiments, as shown in these Figures, the clip 200 engages with the support structure in a direction transverse to the direction in which it engages with the cup.

Figures 4A and 4B show how a wearer is able to move between the first and second cup sizes. In Figure 4A, the cup 116 is attached at the first attachment point 118 to provide a first cup size. The wearer then disengages the clasp 122 from the hook 120 at the first engagement point 118. As shown in Figure 4B, the clasp 122 is then engaged with

the hook 220 at the second engagement point 218. In this manner, the wearer is easily able to transition between the two cup sizes.

Figures 5 and 6 show an alternative design for a clip 300. This clip 300 is substantially “E-shaped”, with a back portion 301 and first, second and third prongs 303A, 303B, 303C extending transverse from this back portion 301. The three prongs 303A, 303B, 303C are spaced apart along the length of the back portion 301. The first and third prongs 303A, 303C are provided with attachment clips 305A, 305B.

These attachment clips 305A, 305B are engageable with the clasp 122 of a bra to provide the second cup size. Depending upon the orientation of the clip 300, one or the other of the attachment clips 305A, 305B will be used to attach the clasp 122 of the bra. By providing these clips 305A, 305B on both of the first and the third prongs 303A, 303C the clip is easily reversible so it can be used on either side of the bra. Preferably the clip 300 is also symmetrical, to aid the reversibility of the clip 300.

Figure 6 shows the clip 300 attached to a bra. As can be seen, the first and third prongs 303A, 303C extend on the front side of the bra strap, with the second prong 303B extending on the rear side of the bra strap. In this manner, the clip 300 is attached to the strap. In preferably embodiments, a grip-enhancing member 307 such as a number of projections and/or roughened patches can be provided on the second prong 303B in order to strengthen this grip.

In alternative embodiments, the attachment clip could be provided on the second, centremost prong 303B. In such an arrangement, the centremost prong 303B would be on the outside of the bra, with the first and third prongs 303A, 303C on the inside.

The provision of the attachable clip allows maternity bras already owned by the wearer to be quickly transformed into bras with quick switchable double cup size options. This allows the use of integrated wearable breast pumps which increase the user’s cup size. This allows more design freedom for the breast pump in terms of size and shape, while still allowing the user to discretely pump with the pump held within their bra. By allowing conversion of the user’s existing maternity bras, they are not forced to purchase specially designed bras to wear with the pump. As such, the present invention allows a

user to discretely switch between the two configurations, and insert the pump without any complex adjustment or removal of clothing.

Preferably, the clip will be relatively unobtrusive in size and shape and hence can be left in place when the bra is first put on and used when necessary. To this end, the clip is preferably machine washable without significant damage or degradation.

In some embodiments, the clip may be switchable between positions for engaging with each cup so that a single clip may be used on either side of the bra. To achieve this, the clip is preferably reversible. This may provide the user with a visual indication of which breast has produced milk most recently so switching can take place.

An alternative embodiment may be provided, with an extendable clip as shown in Figure 7. In such an embodiment the clip is attached to the hook 120 on the strap 102 in a releasable manner, with the clasp 122 attached to an expandable portion of the clip. The clip is then able to expand between an unexpanded state where the clasp 122 is held in substantially the same position as the first attachment point 118 to provide the first cup size, and an expanded state, where the clasp 122 is held in a second position away from the first attachment point 118 to provide the second cup size.

For example, an elongate clip with first and second opposite ends may be provided. A first attachment point for attaching to the hook 120 is provided at the first end, and a second attachment point for attaching to the clasp 122 is provided at the second end. The elongate clip is hinged between the two ends, such that the clip can be folded between an elongate configuration to a closed configuration where the second end touches the first end. A clasp can be provided on the clip to hold the second end in this closed configuration. Thus, in the closed position the clasp 122 is held in substantially the same location as the first attachment point 118 to provide the first cup size, and in the open position the clasp is held away from the first attachment point 118 to provide the second cup size.

Other extendable clip embodiments are also possible, for example sliding clips or elastic clips.

CLAIMS:

1. A maternity bra system comprising:

a maternity bra comprising:

a support structure comprising shoulder straps and a bra band; and

a first and a second cup each attached to the support structure to provide a first cup size, at least one cup being detachable from the support structure at an attachment point,

the system further comprising:

a clip comprising a first engagement mechanism and at least one second engagement mechanism(s), the clip being attachable in a releasable manner to the support structure at a first position via the first engagement mechanism and attachable in a releasable manner to one of the detachable cups via the second engagement mechanism to provide a second cup size different to the first cup size.

2. The maternity bra system of claim 1, wherein the clip is configured to be attached to the support structure at a position away from the attachment point.

3. The maternity bra system of claim 2, wherein the clip is attachable to the support structure at a plurality of non-discrete positions.

4. The maternity bra system of claim 1, wherein:

the clip is extendable between an unextended and an extended state, and attaches to the support structure at the attachment point;

the first cup size is providable when the at least partially detachable cup is attached to the clip when the clip is an unextended state;

the second cup size is providable when the at least partially detachable cup is attached to the clip when the clip is in an extended state.

5. The maternity bra system of any preceding claim, wherein the attachment point is on at least one of the shoulder straps.

6. The maternity bra system of any preceding claim, wherein the second cup size is larger than the first cup size.

7. A clip for use in a system according to any preceding claim, the clip comprising first and section engagement mechanisms and being attachable in a releasable manner to a support structure of a maternity bra with the first engagement mechanism and an at least partially detachable cup of a maternity bra with the second engagement mechanism to provide a second cup size which is different to a first cup size providable when the cup is attached to the support structure of the bra at an attachment point.

8. The maternity bra system or clip of any preceding claim, wherein the first engagement mechanism engages with the support structure in a first direction and the second engagement mechanism engages with the cup in a second direction transverse to the first direction.

9. The maternity bra system of clip of any preceding claim, wherein the second engagement mechanism is one or more of a hook or a snap or a clip.

10. The maternity bra system or clip of any preceding claim, wherein the clip further comprises two distinct second engagement mechanisms which can be used interchangeably dependent upon the orientation of the clip.

11. The maternity bra system or clip of any preceding claim, wherein the clip comprises a material pathway with an opening for receiving a portion of the support structure as the first engagement mechanism for securing the clip to the bra.

12. The maternity bra system or clip of claim 11, wherein the clip is substantially U-shaped, and the material pathway is between the arms of the U.

13. The maternity bra system or clip of any of claims 1 to 11, wherein the clip comprises three prongs extending from a central support, the three prongs arranged as a central prong and two outer prongs so as to receive the support structure on one side of the central prong and on the opposite side of each respective outer prong, at least one prong being provided with the second engagement mechanism.

14. The maternity bra system or clip of claim 13, wherein both outer prongs are each provided with a respective second engagement mechanism.

15. A method of adjusting the cup size of a maternity bra, comprising:

providing a maternity bra comprising:

a support structure comprising shoulder straps and a bra band; and

a first and second cup each attached to the support structure to provide a first cup size, at least one cup being detachable from the support structure at an attachment point,

providing a clip comprising first and section engagement mechanisms;

attaching the first engagement mechanism of the clip in a releasable manner to a first position of the support structure of the maternity bra;

attaching one of the detachable cups to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size.

16. The method of claim 15, further comprising the step of inserting a breast pump into the one of the detachable cup.

17. The method of claim 15 or 16, further comprising the steps of:

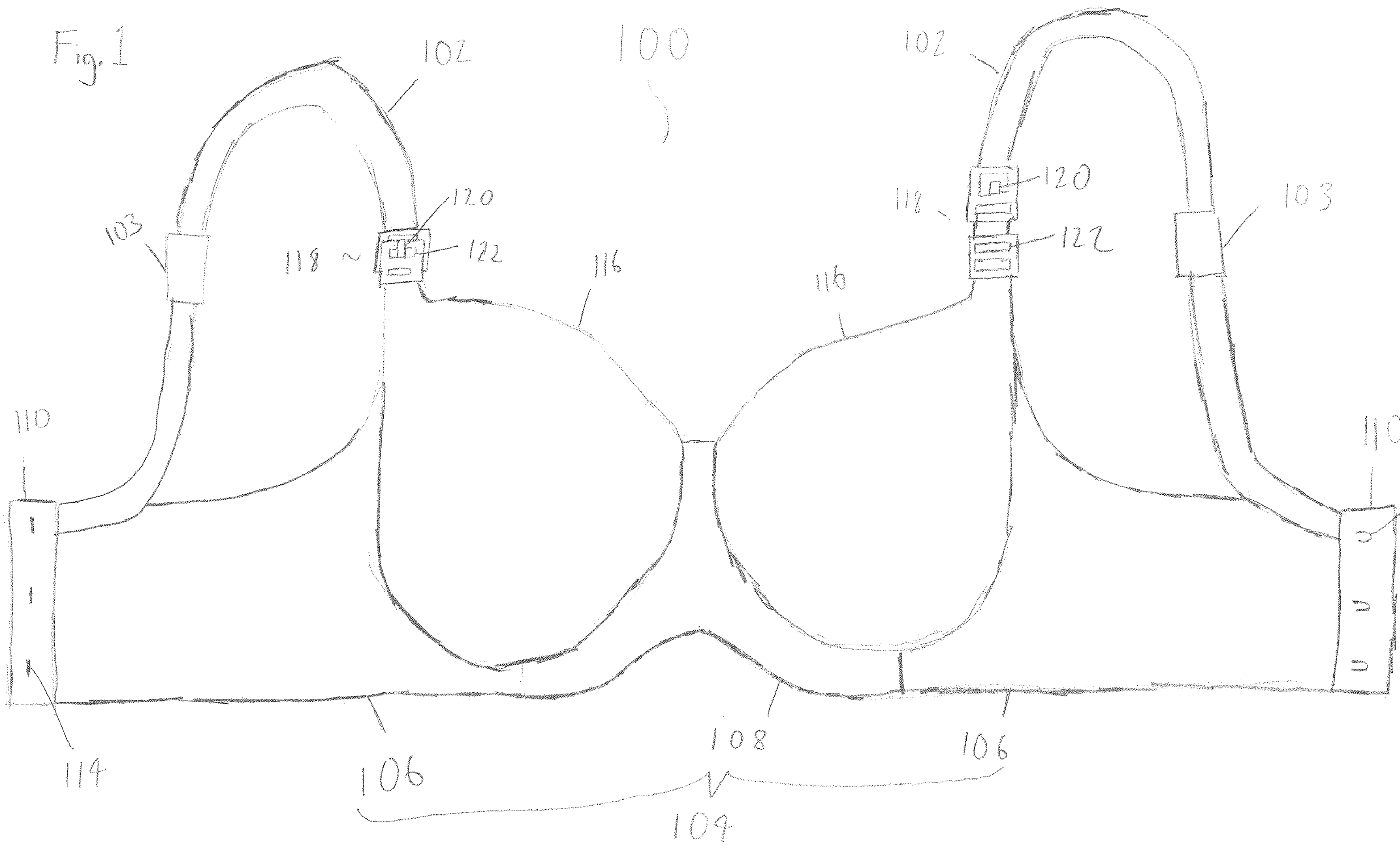
detaching the first engagement mechanism of the clip from the first position support structure of the maternity bra;

attaching the first engagement mechanism of the clip in a releasable manner to a second position of the support structure of the maternity bra; and

attaching the other of the detachable cups to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size.

1/7

Fig. 1



Prior Art

2/7

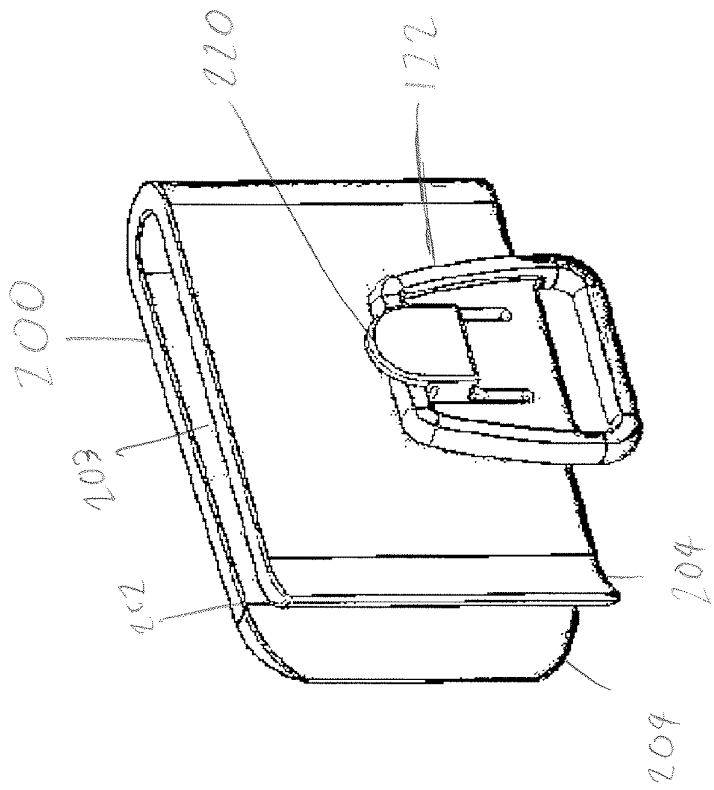


Fig 2B

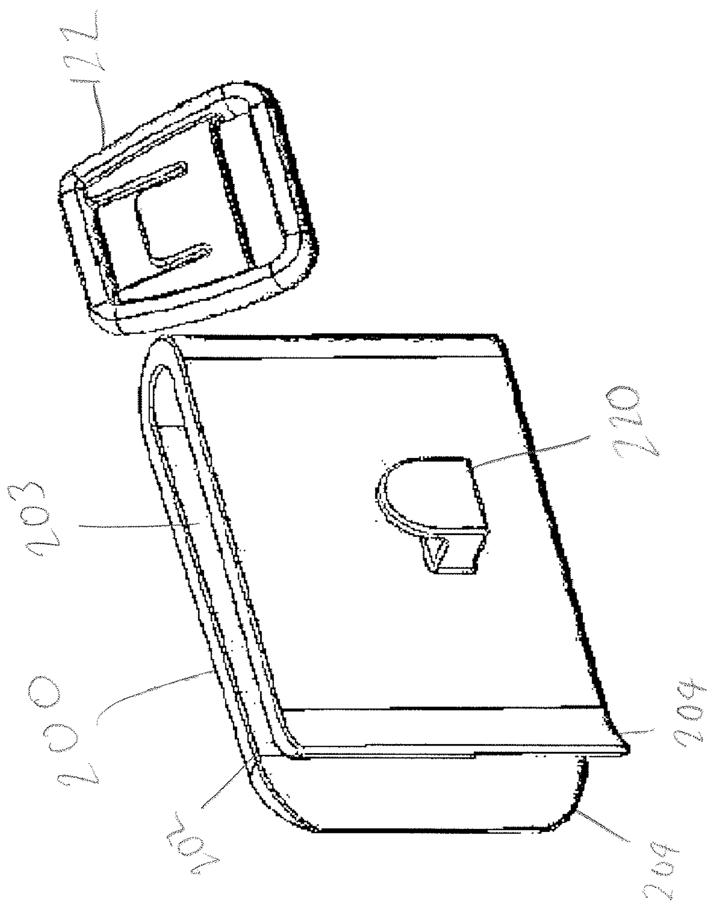
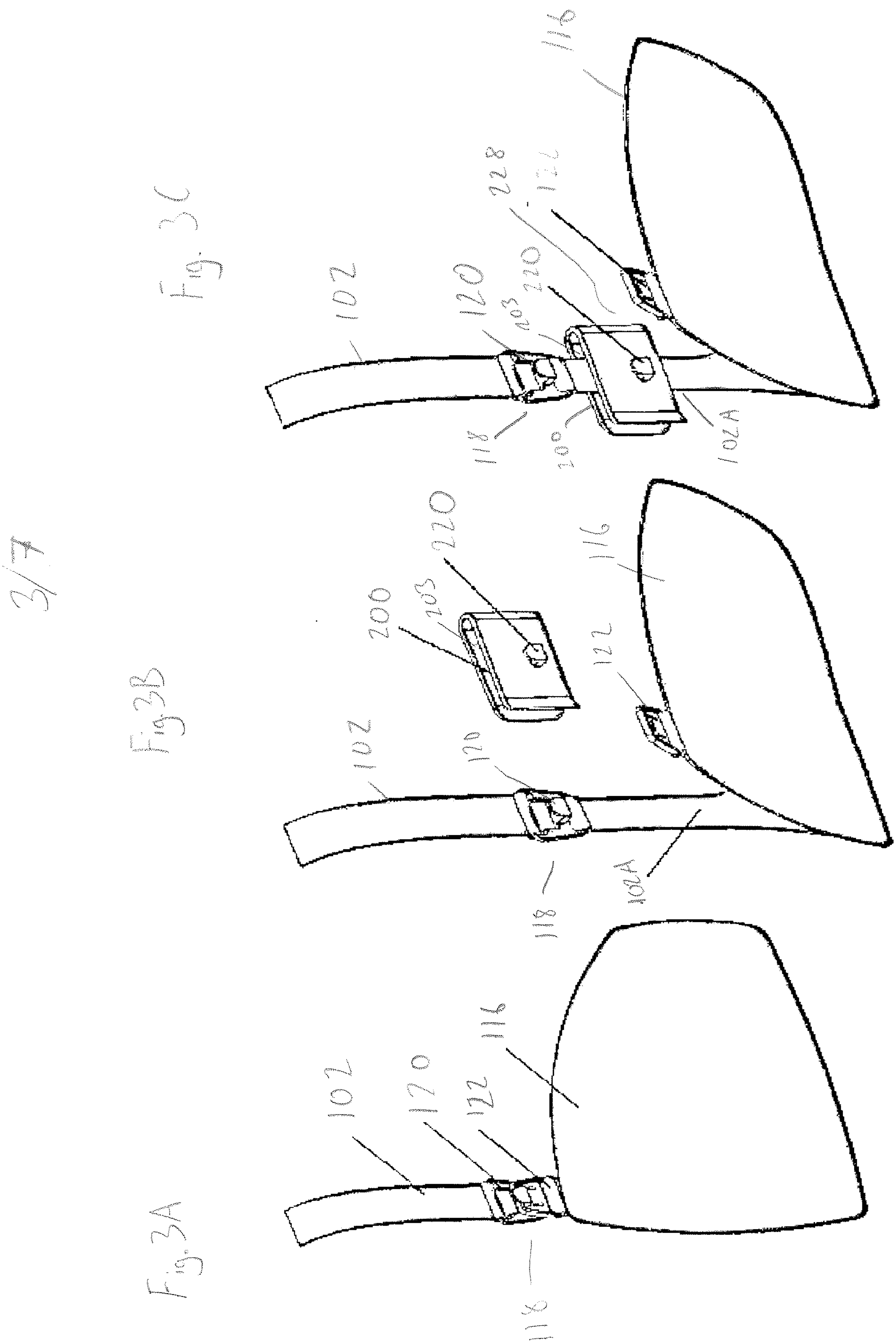


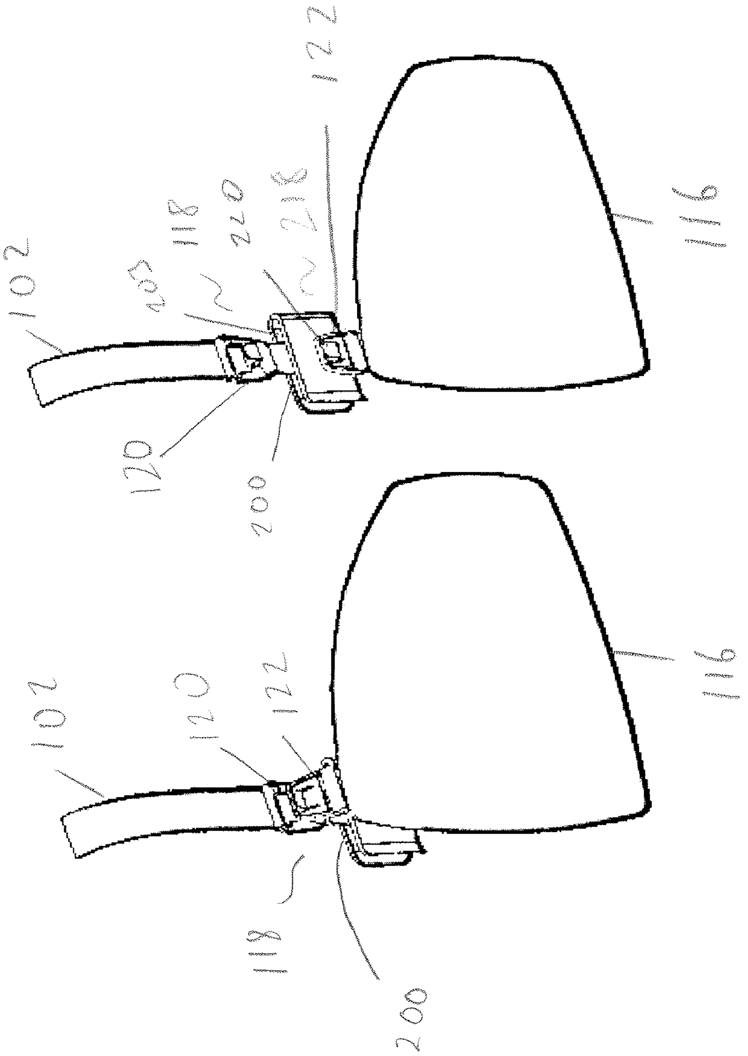
Fig. 2A


3/7
Fig. 3A
Fig. 3B
Fig. 3C
102
120
122
116
118
102A
200
203
220
228

4/7

Fig. 4B

Fig. 4A



5/7

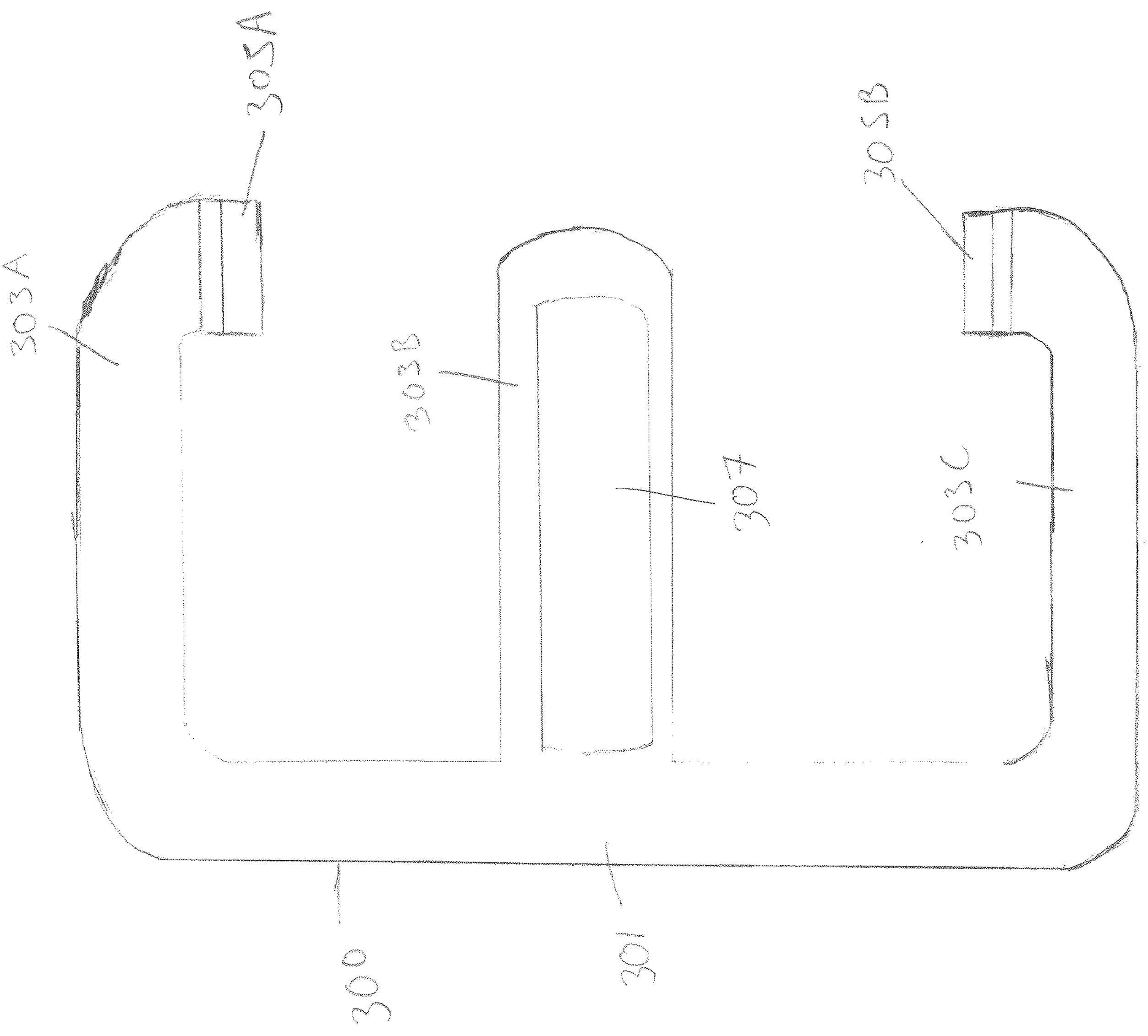


Fig. 5

6/7

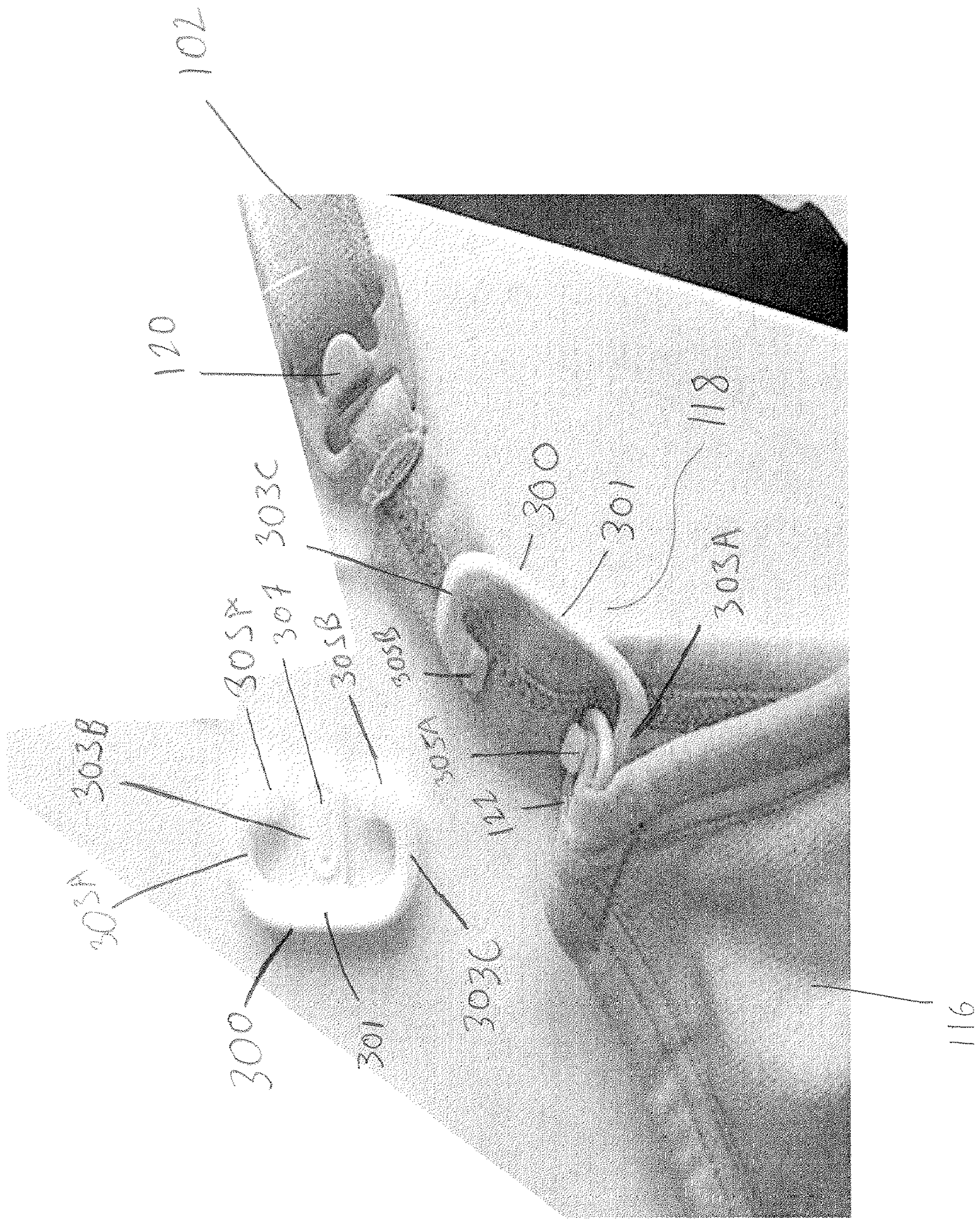


Fig. 6

7/7

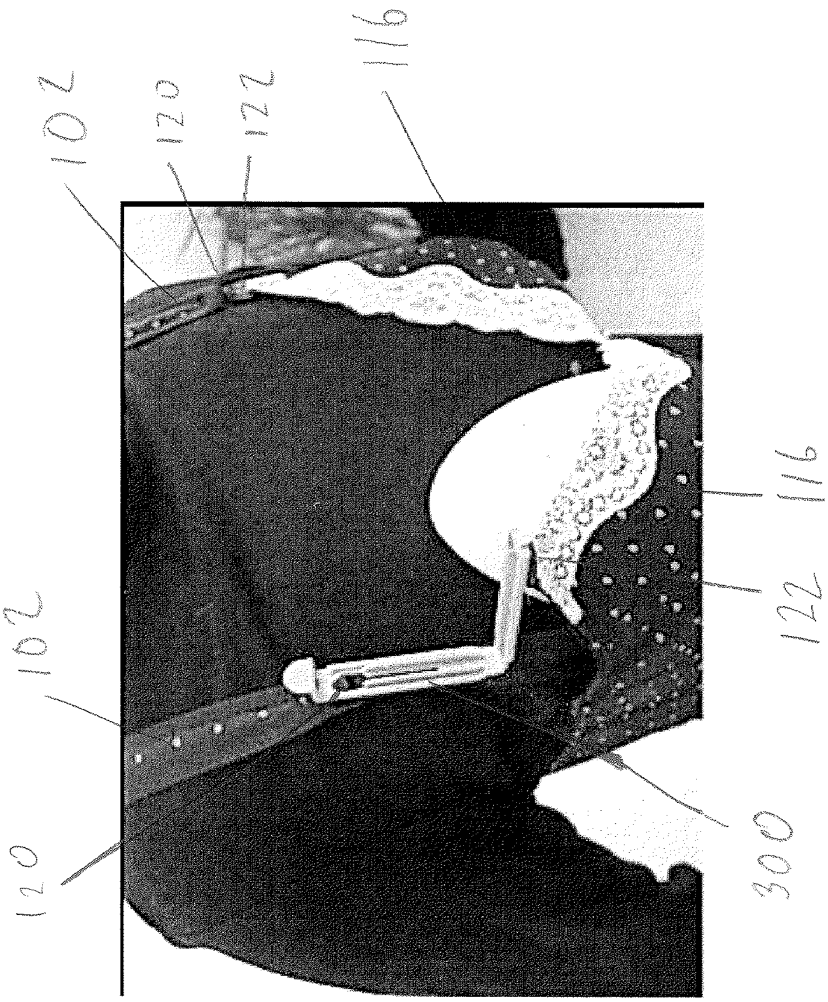


Fig. 7

Digital Access Service
(DAS)

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

CERTIFICATE OF AVAILABILITY OF A CERTIFIED PATENT DOCUMENT IN A DIGITAL LIBRARY

The International Bureau certifies that a copy of the patent application indicated below has been available to the WIPO Digital Access Service since the date of availability indicated, and that the patent application has been available to the indicated Office(s) as of the date specified following the relevant Office code:

Document details:	Country/Office:	GB
	Filing date:	15 Jun 2017 (15.06.2017)
	Application number:	1709566.2

Date of availability of document: 27 Jul 2017 (27.07.2017)

The following Offices can retrieve this document by using the access code:
AR, AT, AU, BE, BR, CA, CL, CN, CO, DK, EA, EE, EP, ES, FI, GB, GE, IB, IL, IN, JP, KR, MA, MX, NL, NO, NZ, SE, US

Date of issue of this certificate: 26 Mar 2021 (26.03.2021)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Certified Office Copy

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with patent application GB1709566.2 filed on 15th June 2017.and as stored electronically on the Patents Electronic Case file System.

The Patents Electronic Case-file System is compliant with British Standard BS10008 - Evidential weight and legal admissibility of information stored electronically and ISO15801 - Electronic imaging – information stored electronically, recommendations for trustworthiness and reliability.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed A HAYES

Dated 19 June 2017

1200242974
1017015616 D02882
15/06/2017 150.00 DepositAccount

Intellectual Property Office

Patents Form 1
Patents Act 1977 *(Rule 12)*

Request for grant of a patent

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Application number GB 1709566.2

1.	Your reference	**MJD/P153992GB00**
2.	Full name, address and postcode of the applicant or of each applicant	**CHIARO TECHNOLOGY LIMITED** **Second Floor 63-66 Hatton Garden** **London EC1N 8LE** **Greater London** **United Kingdom**
	Patents ADP number *(if you know it)*	**11287869002**
3.	Title of the invention	**BREAST PUMP**
4.	Name of your agent *(if you have one)*	**Boult Wade Tennant**
	"Address for service" to which all correspondence should be sent. This may be in the European Economic area or Channel Islands (see warning note below) *(including the postcode)*	**Boult Wade Tennant** **Verulam Gardens** **70, Gray's Inn Road** **London WC1X 8BT** **United Kingdom**
	Patents ADP number *(if you know it)*	**42001**
5.	Priority declaration: Are you claiming priority from one or more earlier-filed patent applications? If so, please give details of the application(s)	

Country	Application number	Date of filing	PDAS Access Code

6.	Divisionals etc: Is this application a divisional application, or being made following resolution of an entitlement dispute about an earlier application. If so, please give the application number and filing date of the earlier application	Number of earlier UK application	Date of filing *(day / month / year)*
7.	Inventorship: (Inventors must be individuals not companies) Are all the applicants named above also inventors?	**No**	
8.	Are you paying the application fee with this form?	**Yes**	

9. Accompanying documents: please enter the number of pages of each item accompanying this form.

Continuation sheets of this form

Description:	**20**
Claim*(s)*:	**6**
Abstract:	**n/a**
Drawing*(s)*:	**13**

If you are not filing a description, please give details of the previous application you are going to rely upon

Country	Application number	Date of filing	PDAS Access Code

10. If you are also filing any of the following, state how many against each item.

Priority documents:	**0**
Statement of inventorship and right to grant of a patent (Patents Form 7):	**1**
Request for search (Patents Form 9A):	**1**
Request for a substantive examination (Patents Form 10):	**0**
Any other documents (please specify):	**PDAS Registration Form**

11. I/We request the grant of a patent on the basis of this application.

Signature: **/DRAPER, Martyn John/** Date: **15 Jun 2017**

12. Name, e-mail address, telephone, fax and/or mobile number, if any, of a contact point for the applicant

DRAPER, Mr Martyn
Email: boult@boult.com
Telephone: 020 7430 7500
Fax: 020 7430 7600

Warning
After an application for a patent has been filed, the Comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you are resident in the United Kingdom and your application contains information which relates to military technology, or would be prejudicial to national security or the safety of the public, section 23 of the Patents Act 1977 prohibits you from applying for a patent abroad without first getting written permission from the Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked. Until such time or until the revocation of any direction, for any such application the address for service referred to at part 4 above must be in the United Kingdom.

Although you may have an address for service in the Channel Islands, any agent instructed to act for you must reside or have a place of business in the European Economic Area or Isle of Man.

BREAST PUMP

BACKGROUND

A breast pump is a mechanical device that extracts milk from the breasts of a lactating woman.

The typical breast pump design is as shown in WO 96/25187 A1. A large suction generating device is provided, which is freestanding. This is attached by air lines to one or two breast shields which engage with the user's breasts. A pressure cycle is applied from the suction generating device, via the air lines, to the breast shields. This generates a pressure cycle on the user's breasts to simulate the suction generated by a feeding child. The suction generating device is a large component that connects to mains power to operate the pumps therein.

Milk collection bottles are provided to store the expressed breast milk. In the system of WO 96/36298 A1 separate bottles are provided attached to each breast shield. However, in alternative embodiments there may be a single bottle with tubing connecting the breast shields thereto. For a mother to use this somewhat discretely, such as in an office environment, specialised bras must be used. In particular, breast-pumping bras which have a central slit, for the spout of the breast shield to extend through are typically used. The breast shield is held within the bra, with the suction generating device and milk bottle outside the bra.

The fundamental breast pump system has not been significantly altered from this, with minor technical improvements being the main developments.

However, these systems present a number of significant disadvantages. As the suction generating device is a large freestanding unit connected to the mains power, the user may feel tethered to the wall. The devices also require a specific user posture and undressing to function normally. This is obviously difficult for a user to do discretely, such as in an office setting.

Fully integrated wearable breast pumps have begun to enter the market, such as US 2016 206794 A1. In such pumps, the suction source, power supply and milk container are locally provided, without the need for bulky external components or connections. Such devices can be provided with a substantially breast shaped profile so as to fit within a

user's bra for discrete pumping, as well as pumping on-the-go without any tethers to electrical sockets or collection stations.

In US 2016 206794 A1, the breast pump has an offset shape favouring the lower half of the pump, and requires complex collapsible bag systems as milk collection devices. This is to force the pump to fit within the user's existing bras.

As the collection bag systems are collapsible, it will be very difficult for a user to extract all of their milk from the bag due to the small cut opening and capillary action between the bonded plastic sheets. This waste can be disheartening for the user as this is food for their child. The bags are also not re-usable, so the user is required to purchase and maintain a stock of these. As well as presenting a recurring cost, if the user runs out of stock they are unable to use the product until more bags are purchased.

Furthermore, as a result of the collapsible bags, a complex pumping arrangement is necessary. In particular, the breast shield connects to a tube which is provided with a plurality of compression units which "step" the expressed milk through the tube to the collection bag. This uses the breast milk as a hydraulic fluid to generate suction on the breast. In order to carry this out, a complex sequenced pulsing arrangement must be implemented.

In addition to these systems being particularly complex and wasteful, a relatively small bag must be used. In US 2016 206794, approximately 110 ml (4 fluid ounces) of milk can be collected before the bag must be changed. While this may be sufficient for some users, others may produce much more milk in a session.

A further integrated wearable breast pump is shown in US 2013 0023821 A1. In the third embodiment in this document, an integral breast pump is provided including a motor driven vacuum pump and power source. An annular (or punctured disc) membrane is provided, with the flow path of the milk going through the centre of the annulus. The membrane is housed in separate housing components and is sealed at its inner and outer edges. The breast shield has a small protrusion to engage with these housing components. However, the design of this breast pump results in a number of problems. The use of an annular membrane, with the fluid flow path running through the opening of the annulus is undesirable as it results in a large and bulky device.

There is therefore a need for improved integrated breast pump systems.

SUMMARY OF THE INVENTION

A breast pump according to a first embodiment of the present invention is provided according to claim 1. This breast pump is for wearing inside a bra, and comprises: a breast shield for engagement with the user's breast; a housing for receiving at least a portion of the breast shield; a pump inside the housing for generating a negative pressure in the breast shield; a battery inside the housing for powering the pump; a detachable rigid milk collection container attachable, in use, to a lower face of the housing and being in connected to the breast shield for collecting milk expressed by the user, with a milk-flow pathway defined from an opening in the breast shield to the milk collection container; and a barrier, the pump acting on one side of the barrier to generate a pressure on the opposite, milk-flow side of the barrier, the barrier having an outer periphery, wherein: the shield, housing, pump, battery and container are provided as a unit with a convex outer surface contoured to fit in a bra; and the milk-flow pathway extends past the outer periphery of the barrier.

This breast pump allows discrete wearing and use, which can fit within a user's bra. The milk-flow path extending past the outer periphery of the barrier allows for a simpler and more robust design, without the milk-flow pathway extending through the barrier. This provides increased interior space and functionality of the device.

A breast pump according to a second embodiment of the present invention is provided according to claim 2. The breast pump is for wearing inside a bra, the breast pump comprising: a breast shield for engagement with the user's breast; a housing for receiving at least a portion of the breast shield; a pump inside the housing for generating a negative pressure in the breast shield; a battery inside the housing for powering the pump; a detachable rigid milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user with a milk-flow pathway defined from an opening in the breast shield to the milk collection container, wherein: the shield, housing, pump, battery and container are provided as a unit with a convex outer surface contoured to fit in a bra; and the breast shield comprises a shield flange for engaging the user's breast, and an elongate spout aligned with the opening and extending away from the user's breast, the spout being substantially aligned, in use, with the user's nipple and areolae; the spout comprising a first opening for depositing milk into

the collection container and a second opening for transferring pressure generated by the pump to the user's nipple, the shield flange and spout being detachable from the housing together.

This breast pump allows discrete wearing and use, which can fit within a user's bra. The shield flange and spout being detachable together helps further simplify the design, and reduce the number of components which must be removed for cleaning and sterilisation.

A breast pump according to a third embodiment of the present invention is provided according to claim 3. This breast pump is for wearing inside a bra, and comprises: a breast shield for engagement with the user's breast; a housing for receiving at least a portion of the breast shield; a piezo pump inside the housing for generating a negative pressure in the breast shield; a battery inside the housing for powering the pump; a detachable milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user with a milk-flow pathway defined from an opening in the breast shield to the milk collection container, wherein the shield, housing, pump, battery and container are provided as a unit with a convex outer surface contoured to fit in a bra.

This breast pump allows discrete wearing and use, which can fit within a user's bra. The piezo pump is ideally suited for this environment as it is low noise and high strength with a compact size.

The breast shield of embodiments 1 or 3 may further comprise a shield flange for engaging the user's breast, and an elongate spout aligned with the opening and extending away from the user's breast, the spout being substantially aligned, in use, with the user's nipple and areolae; the spout comprising a first opening for depositing milk into the collection container and a second opening for transferring pressure generated by the pump to the user's nipple.

The shield flange and spout may be detachable from the housing together. Preferably, the spout will be integral with the breast shield. This helps to simplify the design and reduce the number of components which must be removed for cleaning and sterilisation.

The breast shield cup may extend over a majority of the inner surface of the unit, preferably the breast shield extends over 80% of the inner surface of the unit. This reduces the risk of milk contacting a part of the device which cannot be easily sterilised. This also helps to disperse the pressure applied to the user's breast across a larger area. Additionally, by covering the majority of the inner surface, the breast shield is the only component which contact's the wearer's breast. This leaves fewer surfaces which require thorough cleaning.

The spout may connect directly to the container. By reducing the distance covered by the milk, the device is reduced in size and complexity of small intermediate portions.

The spout may comprise an opening directly above the milk collection container. By reducing the distance covered by the milk, the device is reduced in size and complexity of small intermediate portions.

The breast pump of the second or third embodiments may further comprise a barrier mounted in the breast pump, the pump acting on one side of the barrier to generate a pressure on the opposite, milk-flow, side of the barrier.

Preferably, the barrier has an outer periphery and the milk-flow pathway extends past the outer periphery of the barrier. This allows for a simpler and more robust design, without the milk-flow pathway extending through the barrier.

Preferably the milk-flow pathway extends beneath the barrier. This provides an added benefit of having gravity tend the milk away from the barrier.

Preferably the milk-flow pathway does not pass through the barrier. This results in a simpler and smaller barrier design.

Preferably, the barrier is mounted on a housing on the breast shield. More preferably, the housing is integral with the breast shield. This further helps increase the ease of cleaning and sterilisation as all of the components on the "dirty" side can be removed.

Preferably, the barrier is not an annulus.

The barrier may provide a seal to isolate the pump from the milk-flow side of the barrier. This helps to avoid the milk becoming contaminated from the “dirty” airflow side.

Preferably, the only seal is around an outer edge of the barrier. This is a simple design as only a single seal needs to be formed and maintained. Having multiple seals, such as for an annular membrane, introduces additional complexity and potential failure points.

Preferably, the barrier is a diaphragm.

Preferably, the diaphragm is a continuous membrane which is devoid of any openings or holes. This provides a larger effective “working” area of the diaphragm (i.e. the area of the surface in contact with the pneumatic gasses) than an annular membrane and hence the membrane may be smaller to have the same working area.

The breast pump may further comprise a pressure sensor in pneumatic connection with the piezo pump. This allows the output of the pump to be determined.

Preferably, the width of the breast pump is less than 110 mm.

Preferably, the height of the breast pump is less than 180 mm.

Preferably, the plane to plane depth of the breast pump less than 100 mm.

Preferably, in use, the breast pump extends from the user’s breasts by between 3 to 4 cup sizes as per the European standard EN 13402.

Preferably, the milk container has a volume of greater than 120 ml. More preferably, the milk container has a volume of greater than 140 ml.

Preferably, the milk container has a volume of less than 150 ml.

The milk container and housing may form a substantially continuous outer surface of the breast pump. This helps ensure that the breast pump in use fits within a conventional bra system discretely.

The milk container may be at least partially transparent on the outer surface of the breast pump. This allows the level of milk within the container to be easily observed even while pumping.

The milk container may be provided with a spout. This makes it easier for the end user to pour the collected milk into other containers for use or storage.

The milk container may be provided with attachment means for attaching a teat to the container. This allows the milk container to be used directly as a drinking vessel for a child.

The breast shield may be removable. This allows the shield to be easily washed and sterilised.

The milk collection container may be formed of at least two rigid sections which are connectable. This allows simple cleaning of the container for re-use.

The breast pump may further comprise a one-way valve between an inner surface of the breast shield, for engaging with the breast in use, and the milk container.

The one-way valve may be located in an opening to the container.

The pump of the first or second embodiments may be a piezo pump.

The breast shield may be detachable from the breast pump.

The breast pump of the may further comprise a single pole, double throw pneumatic valve, wherein: the pole is in pneumatic connection with the pump and pressure sensor; one of the throws is in pneumatic connection with the diaphragm; and the other throw is in pneumatic connection with a dead-end.

The breast pump may further comprise: a first non-return valve between the milk-flow side of the diaphragm and the breast shield, configured to allow only a negative pressure to be applied to the breast shield by the pump; a second non-return valve between the milk-flow side of the diaphragm and the milk collection container configured to allow only a positive pressure to be applied to the milk collection container by the pump; and a pressure sensor in pneumatic connection with the pressure-generation side of the diaphragm.

A method of estimating the pressure applied by a breast pump according to an aspect of the present invention is provided according to claim 42, comprising the steps of: providing a breast pump according to the third embodiment; selecting a pressure cycle from a pre-defined list of pressure cycles; applying pressure with the pump to stimulate milk expression; reading the output of the pressure sensor; and adjusting the applied pressure of the pump to match the pressure profile selected. This allows for repeatable application of force to the breast, even as the pump performance degrades.

Preferably the method further comprises the steps of: approximating the elasticity and extension of the diaphragm at the relevant pressure; and calculating an estimated applied pressure based upon the output of the pressure sensor and the approximated elasticity and extension of the diaphragm.

A method of estimating the milk collected by a breast pump according to an aspect of the present invention is provided according to claim 44, comprising the steps of: providing a breast pump according to claim 33; generating a positive pressure with the pump; transmitting the positive pressure via the diaphragm and second non-return valve to only the milk collection container; measuring the increase in pressure by the pressure sensor in pneumatic connection with the diaphragm; estimating the volume of milk inside the milk collection container based upon the rate of increase of pressure. In this manner, the volume of milk can be estimated remotely.

DESCRIPTION OF THE FIGURES

The invention will now be described with respect to the Figures in which:

Figure 1 is a front view of an assembled breast pump;

Figure 2 is a rear view of the assembled breast pump of Figure 1;

Figure 3 is a front view of a partially disassembled breast pump;

Figure 4 is a rear view of the partially disassembled breast pump of Figure 3;

Figure 5 is a front view of a further partially disassembled breast pump;

Figure 6 is a rear view of the further partially disassembled breast pump of Figure 5;

Figure 7 is a front view of the breast pump of Figure 1, with the outer shell translucent for ease of explanation;

Figure 8 is a further front view of the breast pump of Figure 1, with the front of the outer shell removed for ease of explanation;

Figure 9 is a schematic view of a spout for a breast shield;

Figure 10 is a schematic of a pneumatic system for a breast pump;

Figure 11 is a schematic of an alternative pneumatic system for a breast pump;

Figure 12 is a schematic of a further alternative pneumatic system for a breast pump; and

Figure 13 is a graph depicting measured pressure in the breast pump system of Figure 12 over time.

DETAILED DESCRIPTION

Figure 1 is a front view of a breast pump 100 according to the present invention. The breast pump 100 comprises a housing 1 and a milk collection container (or bottle) 3. The milk collection container 3 is attached to a lower face 1A of the housing 1. While the breast pump 100 may be arranged to be used with one of the right or the left breast specifically, it is preferred the breast pump 100 can be used with either breast without modification. To this end, the outer surfaces of the breast pump 100 are preferably substantially symmetrical

The breast pump 100 is further provided with a user interface 5. This may take the form of a touchscreen and/or physical buttons. In particular, this may include buttons, sliders, any form of display, lights, or any other componentry necessary to control and indicate use of the breast pump 100. Such functions might include turning the breast pump 100 on, specifying which breast is being pumped, or increasing the peak pump pressure. Alternatively, the information provided through the user interface 5 might also be conveyed through haptic feedback, such as device vibration, driven from a miniature vibration motor within the pump housing 1.

In the particular embodiment of the Figures, the user interface 5 comprises power button 5A for turning the pump on and off. The user interface 5 further comprises pump up

button 5B and pump down button 5C. These buttons adjust the pressure generated by the pump and hence applied to the user's breast. In preferable embodiments, the pump up button 5B is physically larger than the pump down button 5C. A play/pause button 5D is provided for the user to interrupt the pumping process without turning the device on and off.

The user interface 5 further comprises a breast toggle button 5E for the user to toggle a display of which breast is being pumped. This may be used for data collection, which is discussed in more detail later, or for the user to keep track of which breast has most recently been pumped. In particular, there may be a pair of LEDs, one to the left of the toggle button 5E and one to the right. When the user is pumping the left breast, the LED to the right of the toggle button 5E will illuminate, so that when the user looks down at the toggle it is the leftmost LED from their point of view that is illuminated. When the user then wishes to switch to the right breast, the toggle button can be pressed and the LED to the left of the toggle button 5E will illuminate.

As depicted in Figure 1, the housing 1 and milk collection container 3 form a substantially continuous outer surface, with a generally convex shape. This shape roughly conforms with the shape of a breast. This allows the breast pump 100 to fit within the cup of a user's bra. The milk collection container 3 is retained in attachment with the housing 3 by means of a latch system, which is released by button 2.

The European standard EN 13402 for Cup Sizing defines cup sizes based upon the bust girth and the underbust girth of the wearer and ranges from AA to Z, with each letter increment denoting an additional 2 cm difference. Some manufacturers do vary from these conventions in denomination, and some maternity bras are measured in sizes of S, M, L, XL, etc. In preferred embodiments, the breast pump 100 of the present invention corresponds to an increase of between 3 or 4 cup sizes of the user according to EN 13402.

A plane-to-plane depth of the breast pump can also be defined. This is defined as the distance between two parallel planes, the first of which is aligned with the innermost point of the breast pump 100, and the second of which is aligned with the outermost point of the breast pump 100. This distance is preferably less than 100 mm.

Figure 2 is a rear view of the breast pump 100 of Figure 1. The inner surface of the housing 1 and milk collection container 3 are shown, along with a breast shield 7. The

housing 1, milk collection container 3 and breast shield 7 form the three major sub-components of the breast pump 100. In use, these sub-components clip together to provide the functioning breast pump 100. The breast shield 7 is designed to engage with the user's breast, and comprises a concave inner flange 7A which contacts the breast. To allow the breast pump 100 to be used on either of the user's breasts, the breast shield 7 is preferably substantially symmetrical on its inner flange 7A.

The inner flange 7A is substantially oval-shaped. While the inner flange 7A is concave, it is relatively shallow such that it substantially fits the body form of the user's breast. In particular, when measured side-on the inner-most point of the flange 7A and the outer-most point may be separated by less than 25 mm. By having a relatively shallow concave surface, the forces applied can be spread out over more surface area of the breast. The flatter form also allows easier and more accurate location of the user's nipple. In particular, the flange 7A of the breast shield 7 may extend over the majority of the inner surface of the housing 1 and milk collection container 3. Preferably, it may extend over 80% of this surface.

The breast shield 7 substantially aligns with the outer edge 1B of the housing 1. The milk collection container 3 may be provided with an arcuate groove for receiving a lower part of the breast shield 7. This is best shown in later Figures. In the assembled arrangement of Figures 1 and 2, the inner surface of the breast pump 100 is substantially continuous.

The breast shield 7 further comprises a spout 9 extending from an opening 7B in the breast shield 7. In preferable embodiments the spout 9 is integral with the breast shield 7. However, it is appreciated that separate removable/interchangeable spouts may be used. The opening 7B is aligned with the user's nipple and areola in use. The breast shield 7 forms an at least partial seal with the rest of the user's breast around this portion. This spout 9 defines a milk-flow path from the inner surface of the breast shield 7A, through the spout 9 and into the milk collection container 3. The spout 9 is preferably quite short in order to minimise the length of the milk-flow path in order to minimise losses. In particular, the spout 9 may extend less than 70 mm from its start to end, more preferably less than 50 mm,

Figures 3 and 4 are of a partially disassembled breast pump 100 of the present invention. In these Figures, the breast shield 7 has been disengaged from the housing 1 and milk collection bottle 3. As shown in Figure 4, the housing 1 comprises a slot 11 for receiving the spout 9 of the breast shield 7. The breast shield 7 is held in place by means of a clip 15 engaging with a slot 17 in the housing 1. While this clip 15 is shown at the top of the breast shield 7, it may be placed at any suitable point on the shield 7, with the slot 17 in a corresponding location. The spout 9 of the breast shield 7, is provided with a protrusion 9A on its lower surface. This protrusion 9A is configured to engage with the milk collection bottle 3.

The breast pump 100 further comprises a barrier for transferring the pressure from the pump to the milk-collection side of the system. In the depicted example, this is flexible diaphragm 13. However, it is appreciated that the barrier could be any other suitable component such as a filter or an air transmissive material.

The diaphragm 13 is arranged so that the milk-flow pathway extends past the outer periphery of the diaphragm 13. This means that the milk-flow pathway does not extend through the diaphragm 13. In particular, the milk-flow pathway is beneath the diaphragm 13. However, is appreciated that the diaphragm 13 may be offset in any direction with respect to the milk-flow pathway provided that the milk-flow pathway does not extend through the diaphragm 13.

Preferably, the diaphragm 13 is a continuous membrane, devoid of any openings.

The diaphragm 13 is held in a diaphragm housing 19, which is formed in two parts. The first half 19A of the diaphragm housing 19 is provided on the outer surface of the breast shield 7, above the spout 9 and hence the milk-flow pathway. In preferred embodiments, the first half 19A of the diaphragm housing 19 is integral with the breast shield. The second half 19B of the diaphragm housing is provided in a recessed portion of the housing 1. The diaphragm 13 seals in this diaphragm housing 19 around its outer edge, to form a watertight and airtight seal. Preferably, the seal around the outer edge of the diaphragm 13 is the only seal of the diaphragm 13. This is beneficial over systems with annular diaphragms which must seal at an inner edge as well. Having the diaphragm 13 mounted in the breast pump 100 in this manner ensures that it is easily accessible for

cleaning and replacement. It also ensures that the breast shield 7 and diaphragm 13 are the only components which need to be removed from the pump 100 for cleaning.

Figures 5 and 6 show a breast pump 100 according to the present invention in a further disassembled state. In addition to the breast shield 7 and diaphragm 13 being removed, the milk collection container 3 has been unclipped.

Preferably, the milk collection container 3 is a substantially rigid component. This ensures that expressed milk does not get wasted therein, while also enhancing re-usability. In some embodiments, the milk collection container 3 may be formed of three sections: a front bottle potion, a rear bottle potion, and a cap. These three sections may clip together to form the milk collection container 3. This three part system is easy to empty, easily cleanable, and easily re-usable.

However, in the preferred embodiments the milk bottle 3 is a single integral part with a cap 35. The milk collection container 3 has a capacity of approximately 5 fluid ounces (148 ml).

To achieve this, the milk collection container 3 preferably has a depth in a direction extending away from the breast in use, of between 50 to 80 mm, more preferably between 60 mm to 70 mm, and most preferably between 65 mm to 68 mm.

The milk collection container 3 further preferably has a height, extending in the direction from the bottom of the container 3 in use to the cap 35, of between 40 mm to 60 mm, more preferably between 45 mm to 55 mm, and most preferably between 48 mm to 52 mm.

Further preferably, the milk collection container has a length, extending from the leftmost point to the rightmost point of the container 3 in use, of between 100 mm to 120 mm, more preferably between 105 mm to 115 mm, and most preferably between 107 mm to 110 mm.

This cap 35 is provided with a one-way valve 37, through which milk can flow. This valve 37 prevents milk from spilling from the bottle once it has been collected. In addition, the valve 37 automatically seals completely unless engaged to the breast shield 7. This

ensures that when the pump 100 is dismantled immediately after pumping, no milk is lost from the collection bottle 3. It can be appreciated that this one-way valve 37 might also be placed on the breast shield 7 rather than in this bottle cap 35. The cap 35 may screw into the milk collection bottle 3. In particular, it may be provided with a threaded connection or a bayonet and slot arrangement.

In certain embodiments, a teat may be provided to attach to the annular protrusion 31A to allow the container 3 to be used directly as a bottle. Alternatively, or in addition, a spout may be provided to attach to the protrusion 31A for ease of pouring.

Figures 7 and 8 show front views of a breast pump 100 according to the present invention. The outer-surface of the housing 1 has been drawn translucent to show the components inside. The control circuitry 71 for the breast pump 100 is shown in these figures. The control circuitry in the present embodiment comprises four separate printed circuit boards, but it is appreciated that any other suitable arrangement may be used.

The control circuitry may include sensing apparatus for determining the level of milk in the container 3. The control circuitry may further comprise a wireless transmission device for communicating over a wireless protocol (such as Bluetooth) with an external device. This may be the user's phone, and information about the pumping may be sent to this device. In embodiments where the user interface 5 comprises a breast toggle button 5E, information on which breast has been selected by the user may also be transmitted with the pumping information. This allows the external device to separate pumping data for the left and right breasts.

There should also be charging means within the control circuitry 71 for charging the battery 81. While an external socket, cable or contact point may be required for charging, a form of wireless charging may instead be used such as inductive or resonance charging. In the Figures, charging port 6 is shown for charging the battery 81. This port 6 may be located anywhere appropriate on the housing 1.

Figure 8 shows the location of the battery 81 and the pumps 83A, 83B mounted in series inside the housing 1. While the depicted embodiment shows two pumps 83A, 83B it is appreciated that the present invention may have a single pump.

Preferably, an air filter 86 is provided at the output to the pumps 83A, 83B.In preferable embodiments, the pumps 83A, 83B are piezoelectric pumps (or piezo pump). A suitable piezo pump is manufactured by TTP Ventus, which can deliver in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free flow.

The rear side of the second half of the diaphragm housing 19B in the housing 1 is provided with a pneumatic connection spout. The pumps 83A, 83B are pneumatically connected with this connection spout.

Operation of the breast pump 100 will not be described. Once the breast pump 100 is activated and a pumping cycle is begun, the pumps 83A, 83B generates a negative pressure which is transmitted via the connection spout 85 to a first side of the diaphragm 13 in the diaphragm housing 19. This side of the diaphragm 13 is denoted the pumping side 13B of the diaphragm 13.

The diaphragm 13 transmits this negative pressure to its opposite side (denoted the milk-flow side 13A). This negative pressure is transferred from the first side of the diaphragm housing 19A to the opening 7B of the breast shield 7 via the spout 9. This acts to apply the pressure cycle to the breast of the user, in order to express milk. The milk is then drawn through the spout 9, through the one way valve 37 and into the milk collection container 3. The negative pressure is then released, and periodically reapplied in a manner to imitate the sucking of a child.

While the depicted embodiment of the breast pump 100 is provided with two pumps, the following schematics will be described with a single pump 83. It is understood that the single pump 83 could be replaced by two separate pumps 83A, 83B as above.

Figure 9 depicts a schematic of a further embodiment of a spout 9 for a breast pump 100. The spout 9 is provided with an antechamber 91 and a separation chamber 93. A protrusion 95 extends from the walls of the spout 9 to provide a tortuous air-liquid labyrinth path through the spout 9. In the separation chamber 93 there are two opening 97, 99. An air opening 97 is provided in an upper surface 93A of the separation chamber 93. This upper surface 93 is provided transverse to the direction of the spout 9. This opening 97 connects to the first side of the diaphragm housing 19A and is the source of the negative pressure. This airflow opening 97 also provides a route for air to flow as shown

with arrow 96. It is appreciated that the tortuous pathway is not necessary and that a spout 9 without such a pathway will work.

The other opening 99 is a milk opening 99. The milk opening 99 is provided on a lower surface 93B of the separation chamber 93 and connects in use to the container 3. After flowing through the tortuous spout 9 pathway, the milk is encouraged to flow through this opening 99 into the container 3. This is further aided by the transverse nature of the upper surface 93A.

In this manner, expressed milk is kept away from the diaphragm 13. As such, the breast pump 100 can be separated into a “clean” air-flow side comprising the pump 83, the connection spout 85 and the pumping side 13B of the diaphragm 13 and a “dirty” milk-flow side comprising the breast shield 7, the milk collection container 3 and the milk-flow side 13A of the diaphragm 13. This ensures that all of the “dirty” components are easily detachable for cleaning, maintenance and replacement. Additionally, the milk is kept “clean” by ensuring it does not contact the mechanical components.

While the present embodiment discusses the generation of negative pressure with the pump 83, it will be appreciated that positive pressure may instead be generated.

While the embodiments described herein use a diaphragm 13, any suitable structure to transmit pressure while isolating either side of the system may be used.

Figure 10 shows a schematic of a basic pneumatic system 200 for a breast pump 100. In the system 200 milk expressed into the breast shield 7 is directed through the breast shield spout 9 through the torturous air-liquid labyrinth interface 95. The milk is directed through the non-return valve 37 to the collection container 3. This side of the system forms the “dirty” side 201.

The rest of the pneumatic system 200 forms the “clean” side 202 and is separated from contact with milk. This is achieved by way of a flexible diaphragm 13 which forms a seal between the two sides of the system. The diaphragm 13 has a milk-flow side 13A and an air-flow side 13B.

The “clean” side 202 of the system 200 is a closed system. This side 202 may contain a pressure sensor 101 in pneumatic connection with the diaphragm 13 and the pump 83. Preferably, the pump 83 is a piezoelectric pump (or piezo pump). Due to their low noise, strength and compact size, piezoelectric pumps are ideally suited to the embodiment of a small, wearable breast pump. The pump 83 has an output 83A for generating pressure, and an exhaust to the atmosphere 83B. In a first phase of the expression cycle, the pump 83 gradually applies negative pressure to clean half of the closed system 202 behind the diaphragm 13. This causes the diaphragm 13 to extend away from the breast, and thus the diaphragm 13 conveys a decrease in pressure into the breast shield 7. The reduced pressure encourages milk expression from the breast, which is directed through the tortuous labyrinth system 95 and the one-way valve 37 to the collection bottle 3.

While in the depicted embodiment the exhaust 83B is not used, it may be used for functions including, but not limited to, cooling of electrical components, inflation of the bottle to determine milk volume (discussed further later) or inflation of a massage bladder against the breast. This massage bladder may be used to help mechanically encourage milk expression.

The “clean” side 202 further comprises a two-way solenoid valve 103 connected to a filtered air inlet 105 and the pump 83. Alternatively, the filter could be fitted on the pump line 83A. If the filter is fitted here, all intake air is filtered but the performance of the pump may drop. After the negative pressure has been applied to the user’s breast, air is bled into the system 202 through the valve 103 in a second phase of the expression cycle. In this embodiment, the air filter 105 is affixed to this inlet to protect the delicate components from degradation. In particular, in embodiments with piezoelectric components these are particularly sensitive.

The second phase of the expression cycle and associated switching of valve 103 is actioned once a predefined pressure threshold has been reached. The pressure is detected by a pressure sensor 101.

In certain embodiments, if the elasticity and extension of the diaphragm 13 may be approximated mathematically at different pressures, the pressure measured by sensor 101 can be used to infer the pressures exposed to the nipple on the opposite side of the diaphragm 13.

Figure 11 shows an alternative pneumatic system 300. The core architecture of this system is the same as the system shown in Figure 10.

In this system 300, the closed loop 202 is restricted with an additional three way solenoidal valve 111. This valve 111 allows the diaphragm 13 to be selectively isolated from the rest of the closed loop 202. This additional three way valve 111 is located between the diaphragm 13 and the pump 83. The pressure sensor 101 is on the pump 83 side of the three way valve 111. The three way valve 111 is a single pole double throw (SPDT) valve, with the diaphragm 13 connected to one of the throws 111B. The pump 83 is connected to the pole 111A. The final throw 111C is connected to a dead-end 113. This dead-end 113 may either be a simple closed pipe, or any component(s) that does not allow the flow of air into the system 202. This could include, for example, an arrangement of one-way valves.

In this system 300, therefore, the pump 83 has the option of applying negative pressure directly to the pressure sensor 101. This allows repeated testing of the pump in order to calibrate pump systems, or to diagnose issues with the pump in what is called a dead end stop test. This is achieved by throwing the valve to connect the pump 83 to the dead end 113. The pump 83 then pulls directly against the dead end 113 and the reduction of pressure within the system can be detected by the pressure sensor 101.

Using this function, material fatigue of the pump 83 can be assessed directly. Principally, this knowledge can be used to ensure user experience is not altered, despite the changing output of the pump 83 as it degrades over time. For example, the pump cycle may be changed to drive longer or operate under increased voltage to ensure the same pressures are met. This is particularly relevant for piezo pumps where the output may vary significantly.

Figure 12 shows a schematic for a system 400 for a breast pump 100 which can estimate the volume of milk collected in the collection container 3 from data collected on the “clean” airflow part 202 of the system 400.

The pump 83 is connected to the circuit via two bleed valves 126, 128. The first bleed valve 126 is arranged to function when the pump 83 applies a negative pressure. As

such, this valve 126 is connected to a “bleed in” 127, for supplying atmospheric air to the system 202.

The second bleed valve 128 is arranged to function when the pump 83 applies a positive pressure. As such, this valve 128 is connected to a “bleed out” 129 for bleeding air in the system 202 to the atmosphere.

During a milking pump cycle, the pump 83 applies negative pressure on the “clean” side 13B of the diaphragm 13 which causes its extension towards the pump 83. This increases the volume of the space on the “dirty” side 13B of the diaphragm 13. This conveys the decrease in pressure to the breast to encourage expression of milk. A set of three non-return valves 121, 123, 125 ensure that this decrease in pressure is applied only to the breast (via the breast shield 7) and not the milk collection container 3.

To measure the volume of milk collected in the container 3, the pump 83 is used instead to apply positive pressure to the diaphragm 13. The diaphragm 13 is forced to extend away from the pump 83 and conveys the pressure increase to the “dirty side” 201 of the system 400. The three non-return valves 121, 123, 125 ensure that this increase in pressure is exclusively conveyed to the milk collection container 13.

The resulting pressure increase is monitored behind the diaphragm 13 from the “clean” side 202 by a pressure sensor 101. Preferably, the pressure sensor 101 is a piezoelectric pressure sensor (piezo pressure sensor). The rate at which the pump 83 (at constant strength) is able to increase the pressure in the system 400 is a function of the volume of air that remains in the milk collection container 3. As air is many times more compressible than liquid, the rate at which pressure increases in the system 400 can be expressed as an approximate function of the volume of milk held in the collection container 3.

Thus by increasing the pressure in this fashion, the rate of pressure increase can be determined, from which the volume of milk held in the container 3 is calculable.

The inventor has proved this method for estimating milk volume. Figure 13 shows repeated milking and volume measurement cycles as the collection container 3 is filled. To determine the rate of pressure increase the pump 83 was run for a fixed time. As pumping

proceeds and the volume of air reduces in the system 400, the pump 83 is able to achieve a higher pressure. Each milking cycle is represented by a positive pressure spike 41. There is a clear upwards trend 43 in magnitude of positive pressures achieved as the collection container 3 is filled.

In this manner, an estimate can be obtained for the volume of milk in the container 3 based upon the measured pressures.

Figure 13 also shows a dead end stop pump test 45 as described above. The negative spike 45 shows the application of negative pressure directly to the pressure sensor 101.

CLAIMS:

1. A breast pump for wearing inside a bra, the breast pump comprising:

a breast shield for engagement with the user's breast;

a housing for receiving at least a portion of the breast shield;

a pump inside the housing for generating a negative pressure in the breast shield;

a battery inside the housing for powering the pump;

a detachable rigid milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user with a milk-flow pathway defined from an opening in the breast shield to the milk collection container; and

a barrier, the pump acting on one side of the barrier to generate a pressure on the opposite, milk-flow, side of the barrier, the barrier having an outer periphery,

wherein:

the shield, housing, pump, battery and container are provided as a unit with a convex outer surface contoured to fit in a bra; and

the milk-flow pathway extends past the outer periphery of the barrier.

2. A breast pump for wearing inside a bra, the breast pump comprising:

a breast shield for engagement with the user's breast;

a housing for receiving at least a portion of the breast shield;

a pump inside the housing for generating a negative pressure in the breast shield;

a battery inside the housing for powering the pump;

a detachable rigid milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user with a milk-flow pathway defined from an opening in the breast shield to the milk collection container,

wherein:

the shield, housing, pump, battery and container are provided as a unit with a convex outer surface contoured to fit in a bra; and

the breast shield comprises a shield flange for engaging the user's breast, and an elongate spout aligned with the opening and extending away from the user's breast, the spout being substantially aligned, in use, with the user's nipple and areolae; the spout comprising a first opening for depositing milk into the collection container and a second opening for transferring pressure generated by the pump to the user's nipple, the shield flange and spout being detachable from the housing together.

3. A breast pump for wearing inside a bra, the breast pump comprising:

a breast shield for engagement with the user's breast;

a housing for receiving at least a portion of the breast shield;

a piezo pump inside the housing for generating a negative pressure in the breast shield;

a battery inside the housing for powering the pump;

a detachable milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user with a milk-flow pathway defined from an opening in the breast shield to the milk collection container,

wherein the shield, housing, pump, battery and container are provided as a unit with a convex outer surface contoured to fit in a bra.

4. The breast pump according to claim 1 or 3 wherein the breast shield comprises a shield flange for engaging the user's breast, and an elongate spout aligned with the opneing extending away from the user's breast, the spout being substantially aligned, in use, with the user's nipple and areolae; the spout comprising a first opening for depositing milk into the collection container and a second opening for transferring pressure generated by the pump to the user's nipple.

5. The breast pump of claim 4, wherein the shield flange and spout are detachable from the housing together

6. The breast pump of claim 2, 4 or 5, wherein the spout is integral with the breast shield.

7. The breast pump according to claim 2 or 4 to 6, wherein the breast shield cup extends over a majority of the inner surface of the unit.

8. The breast pump of claim 7, wherein the breast shield extends over 80% of the inner surface of the unit.

9. The breast pump of any of claims 2 or 4 to 8, wherein the spout connects directly to the container.

10. The breast pump of any of claims 2 or 4 to 9, wherein the spout comprises an outflow opening for depositing milk directly above the milk collection container.

11. The breast pump of any of claims 2 or 3, and claims 4 to 10 when dependent upon claims 2 or 3, further comprising a barrier, the pump acting on one side of the barrier to generate a pressure on the opposite, milk-flow, side of the barrier.

12. The breast pump of claim 10, wherein the barrier has an outer periphery and the milk-flow pathway extends past the outer periphery of the barrier.

13. The breast pump of any of claims 2, 11 or 12, wherein the milk-flow pathway is beneath the barrier.

14. The breast pump of any of claims 2 or 11 to 13, wherein the milk-flow pathway does not pass through the barrier.

15. The breast pump of any of claims 2 or 11 to 14, wherein the barrier is mounted in a housing on the breast shield.

16. The breast pump of claim 15, wherein the housing is integral with the breast shield.

17. The breast pump of any of claims 2 or 11 to 16, wherein the barrier is not an annulus.

18. The breast pump of any of claims 2 or 11 to 17, wherein the barrier provides a seal to isolate the pump from the milk-flow side of the barrier.

19. The breast pump of claim 18, wherein the only seal is around an outer edge of the barrier.

20. The breast pump of any of claims 2 or 11 to 19, wherein the barrier is a diaphragm.

21. The breast pump of claim 20, wherein the diaphragm is a continuous membrane which is devoid of any openings or holes.

22. The breast pump according to any preceding claim, further comprising a pressure sensor in pneumatic connection with the pump.

23. The breast pump of any preceding claim, wherein the width of the breast pump is less than 110 mm.

24. The breast pump of any preceding claim, wherein the height of the breast pump is less than 180 mm.

25. The breast pump of any preceding claim, wherein the plane to plane depth of the breast pump is less than 100 mm.

26. The breast pump of any preceding claim, wherein, in use, the breast pump extends from the user's breasts by 3 to 4 cup sizes as per the European standard EN 13402.

27. The breast pump of any preceding claim, wherein the milk container has a volume of greater than 120 ml.

28. The breast pump of claim 27, wherein the milk container has a volume of greater than 140 ml.

29. The breast pump of claim 27 or 28, wherein the milk container has a volume of less than 150 ml.

30. The breast pump of any preceding claim, wherein the milk container and housing form a substantially continuous outer surface of the breast pump.

31. The breast pump of any preceding claim, wherein the milk container is at least partially transparent on the outer surface of the breast pump.

32. The breast pump of any preceding claim, wherein the milk container is provided with a spout.

33. The breast pump of any preceding claim, wherein the milk container is provided with attachment means for attaching a teat to the container.

34. The breast pump of any preceding claim, wherein the breast shield is removable.

35. The breast pump of any preceding claim, wherein the milk collection container is formed of at least two rigid sections which are connectable.

36. The breast pump of any preceding claim, further comprising a one-way valve between an inner surface of the breast shield, for engaging with the breast in use, and the milk container.

37. The breast pump of claim 36, wherein the one-way valve is located in an opening to the container.

38. The breast pump of claim 1 or 2, wherein the pump is a piezo pump.

39. The breast pump of any of any preceding claim, wherein the breast shield is detachable from the breast pump.

40. The breast pump of any of claims 22 or 23 to 39 when dependent upon claim 22, further comprising a single pole, double throw pneumatic valve, wherein:

the pole is in pneumatic connection with the pump and pressure sensor;

one of the throws is in pneumatic connection with the diaphragm; and

the other throw is in pneumatic connection with a dead-end.

41. The breast pump of any of claim22 or 23 to 40 when dependent upon claim 22, further comprising:

a first non-return valve between the milk-flow side of the diaphragm and the breast shield, configured to allow only a negative pressure to be applied to the breast shield by the pump;

a second non-return valve between the milk-flow side of the diaphragm and the milk collection container configured to allow only a positive pressure to be applied to the milk collection container by the pump; and

a pressure sensor in pneumatic connection with the pressure-generation side of the diaphragm.

42. A method of estimating the pressure applied by a breast pump according to claim 40, comprising the steps of:

providing a breast pump according to claim 40;

selecting a pressure cycle from a pre-defined list of pressure cycles;

applying pressure with the pump to stimulate milk expression;

reading the output of the pressure sensor;

adjusting the applied pressure of the pump to match the pressure profile selected by the user.

43. The method of claim 42, further comprising:

approximating the elasticity and extension of the diaphragm at the relevant pressure; and

calculating an estimated applied pressure based upon the output of the pressure sensor and the approximated elasticity and extension of the diaphragm.

44. A method of estimating the milk collected by a breast pump according to claim 41, comprising the steps of:

providing a breast pump according to claim 41;

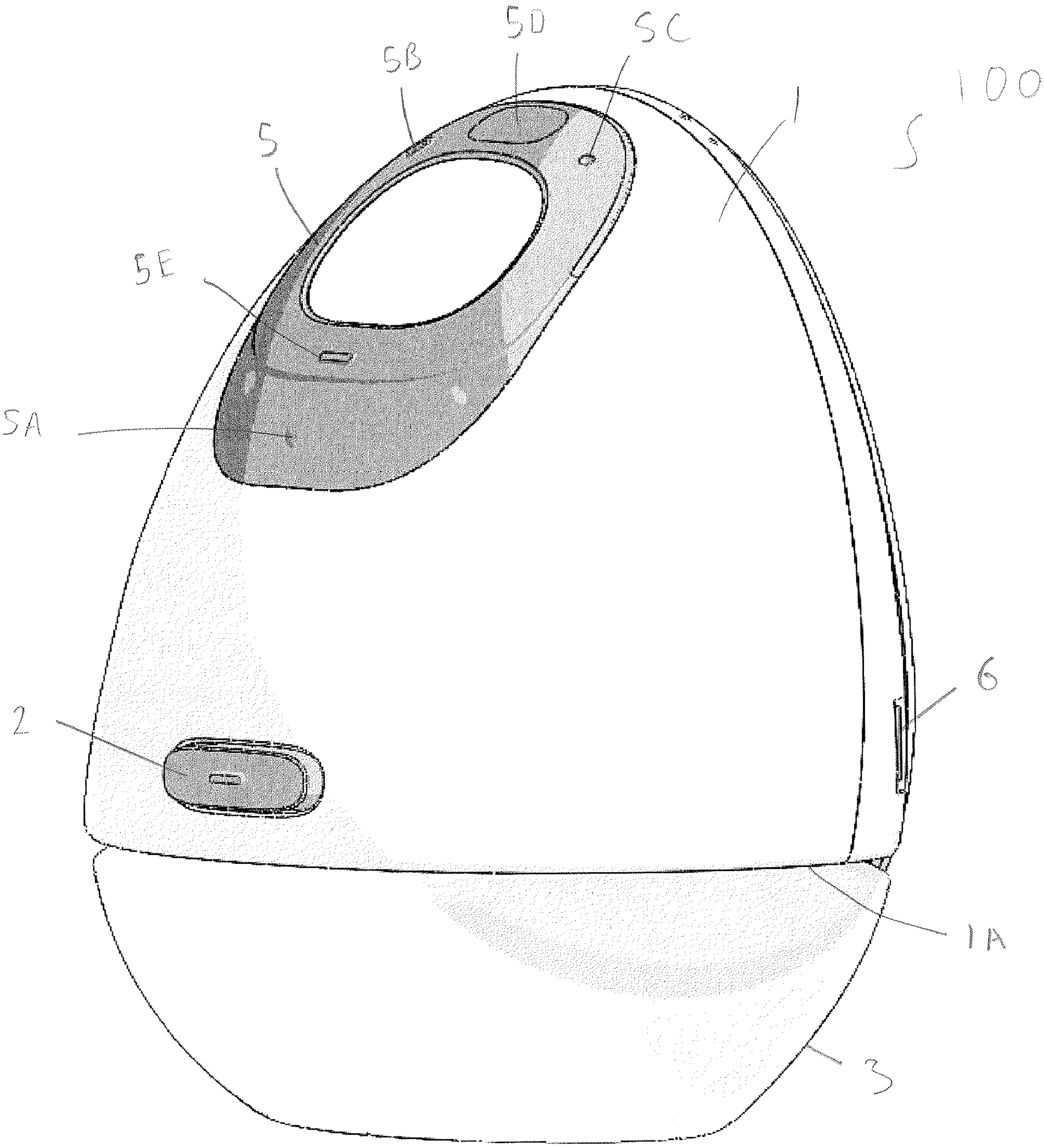
generating a positive pressure with the pump;

transmitting the positive pressure via the diaphragm and second non-return valve to only the milk collection container;

measuring the increase in pressure by the pressure sensor in pneumatic connection with the diaphragm;

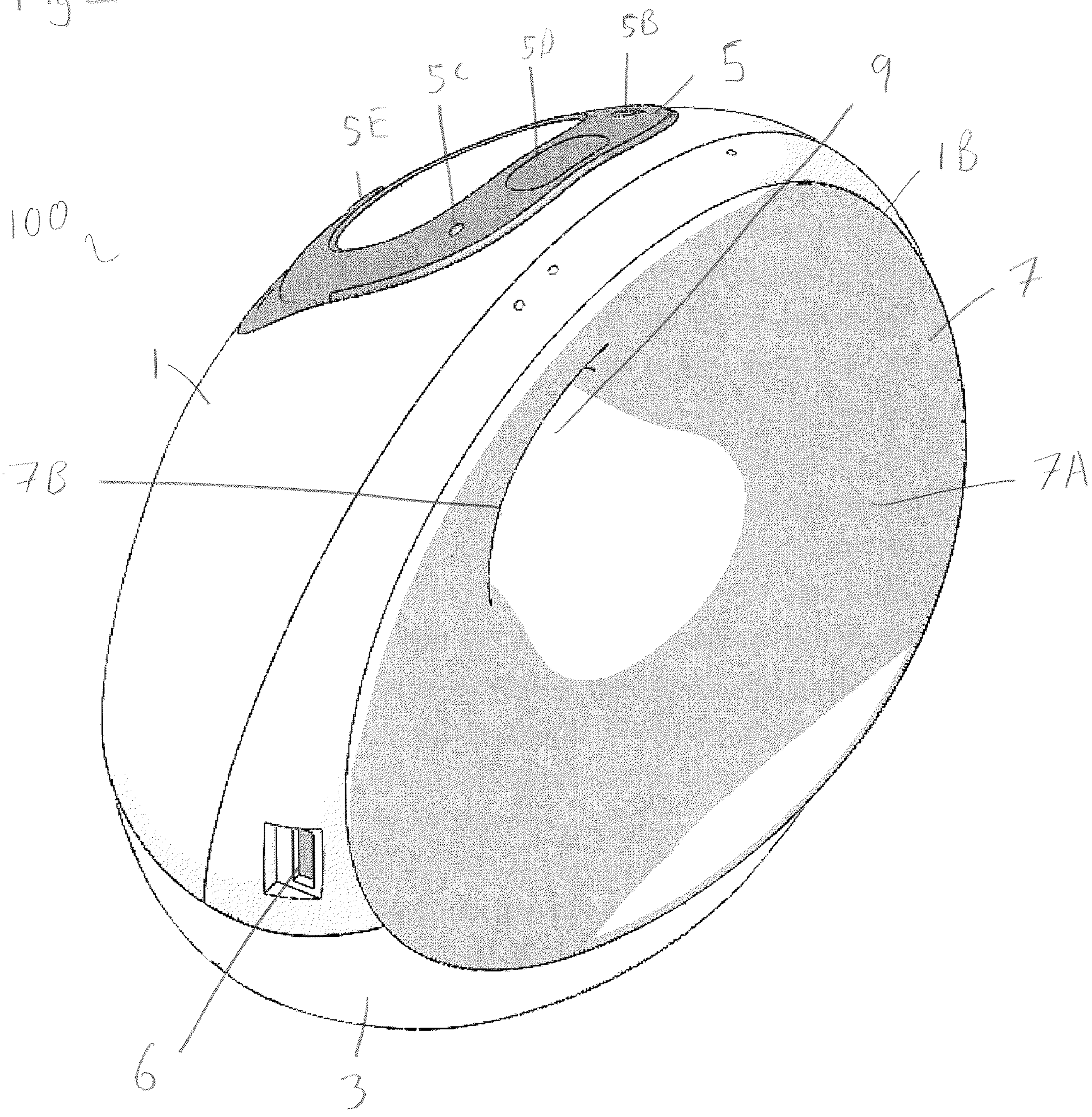
estimating the volume of milk inside the milk collection container based upon the rate of increase of pressure.

P153992GB00



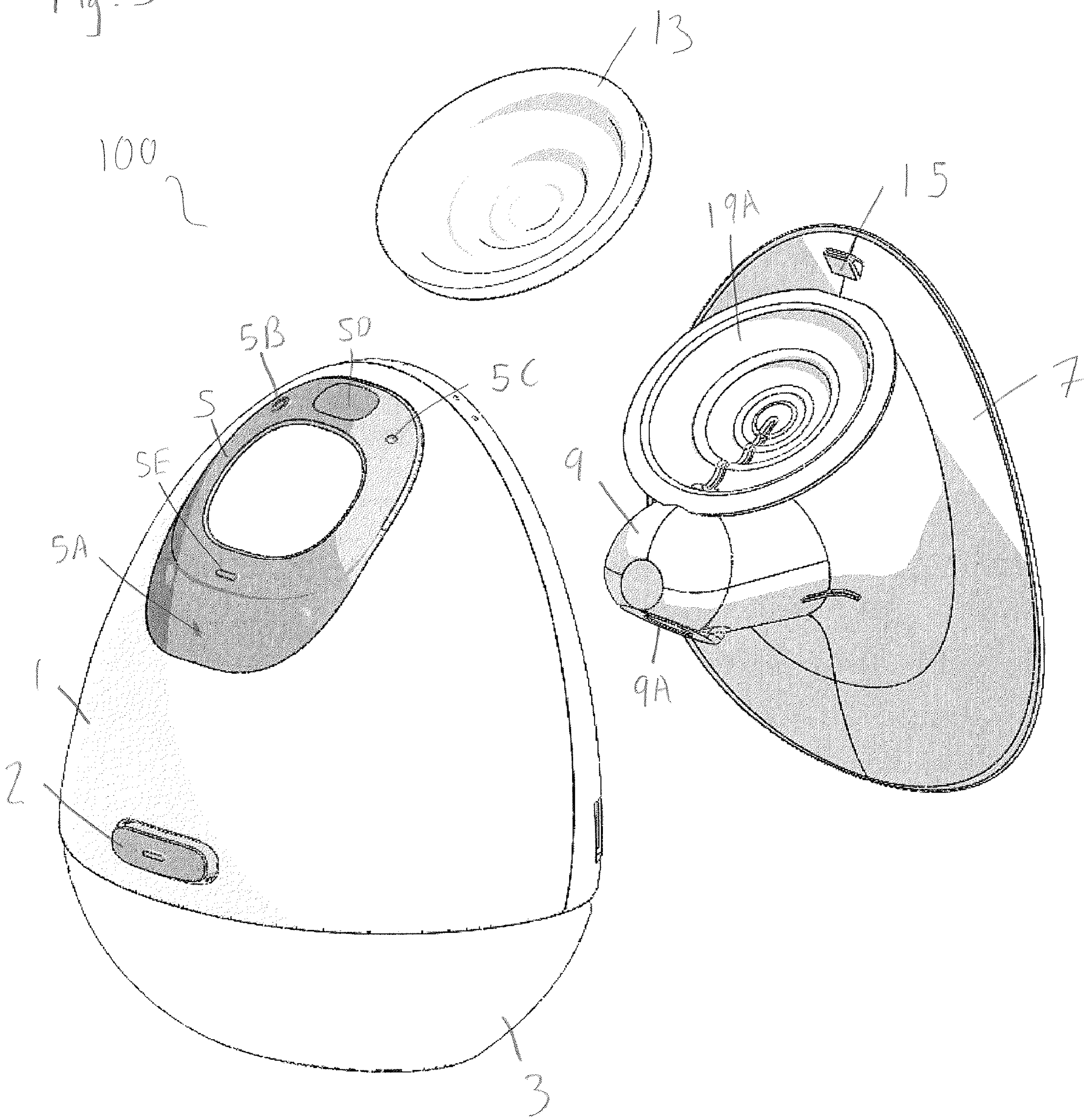
P153992GB00

Fig 2



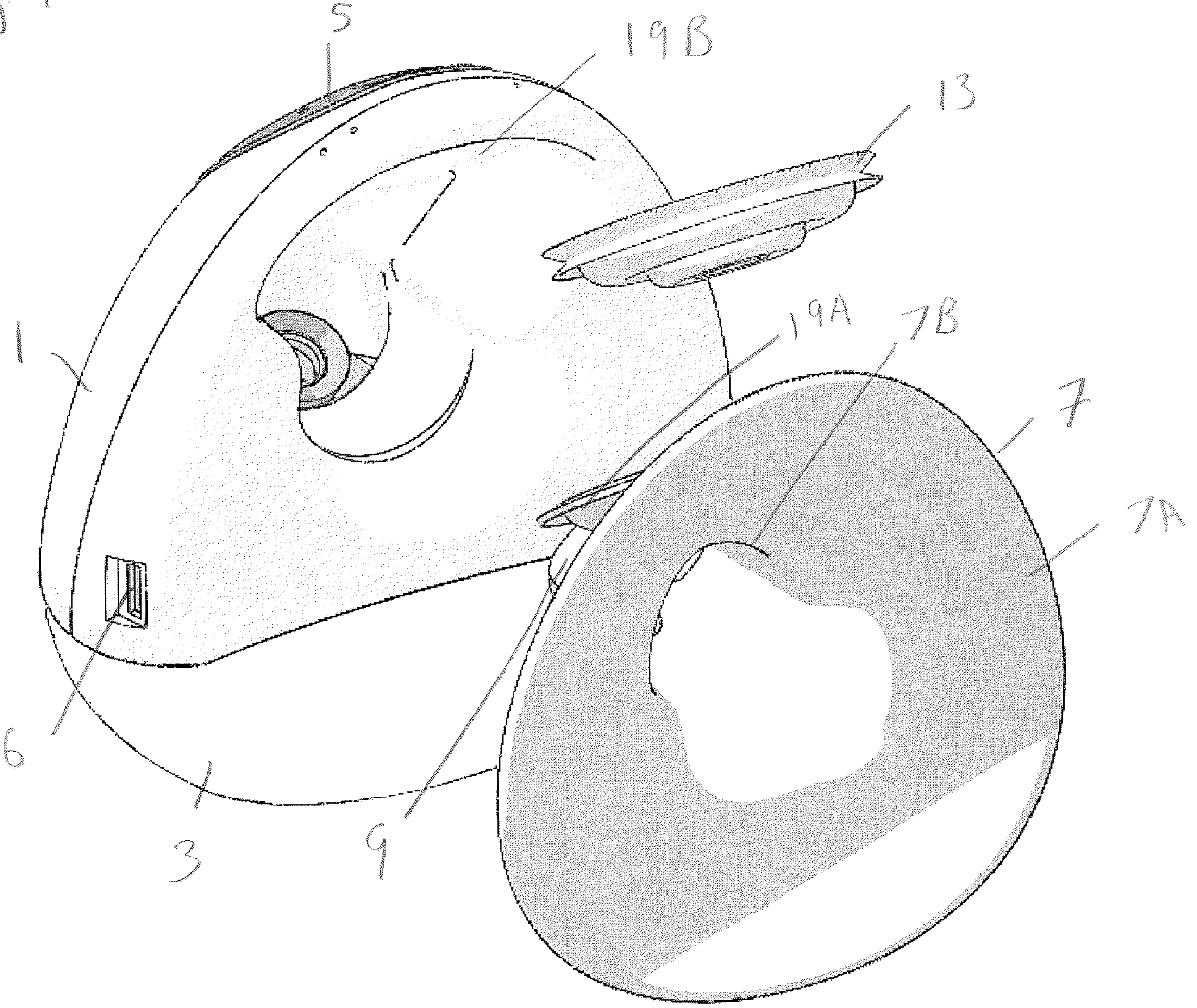
P153992GB00

Fig. 3



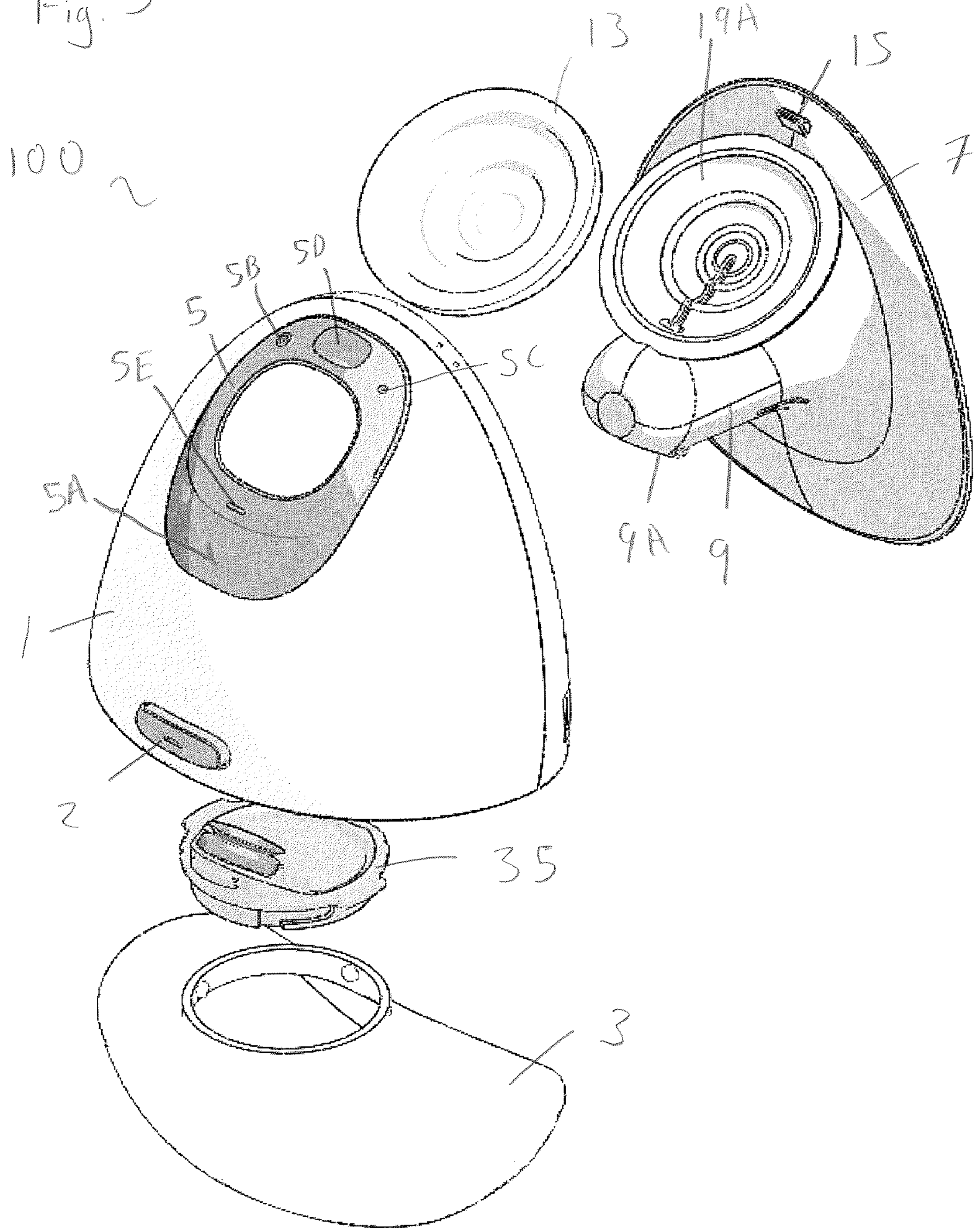
P153992GB00

Fig. 4



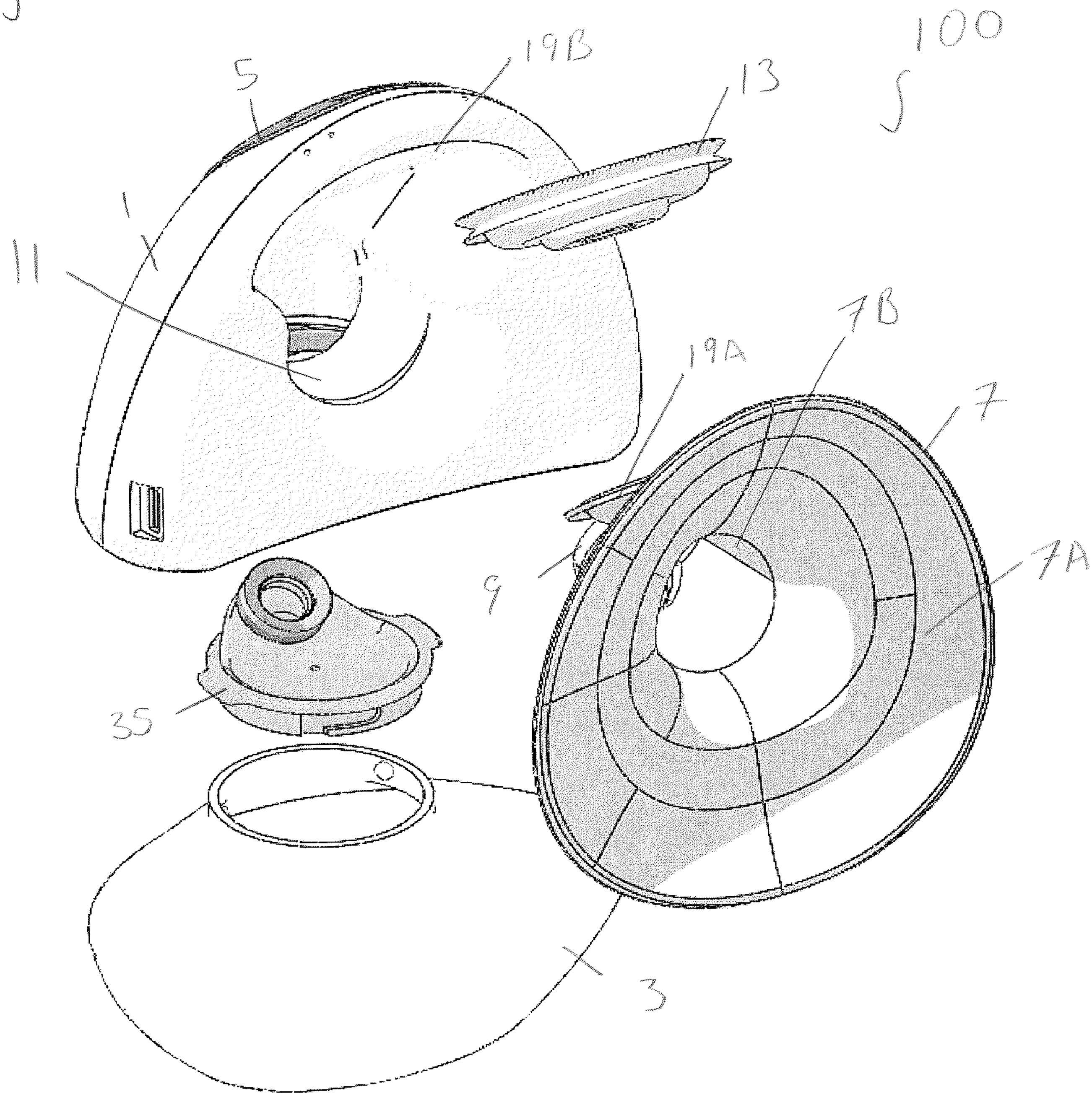
P153992GB00

Fig. 5



P153992GB00

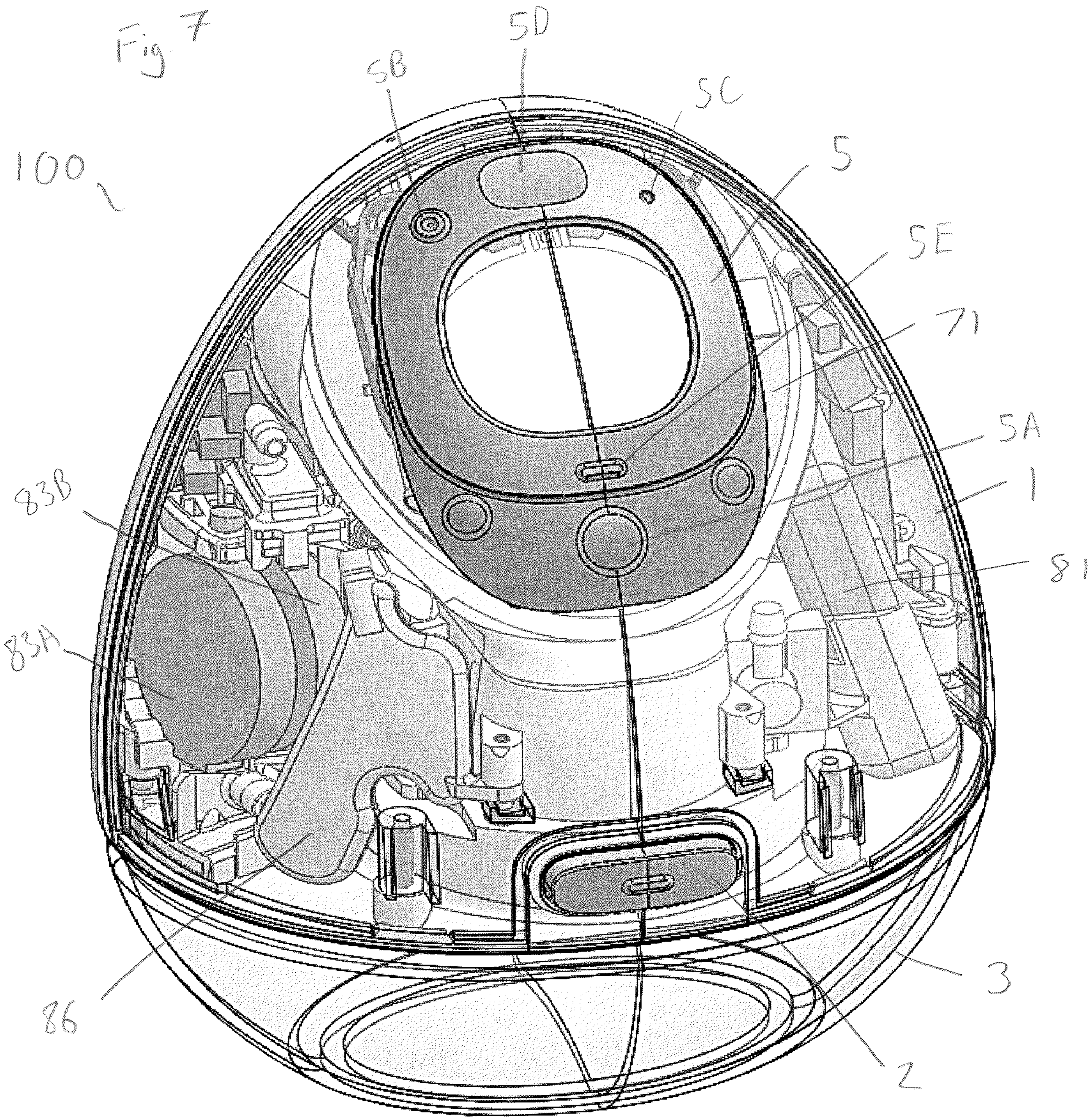
Fig. 6



7/13

P153992GB00

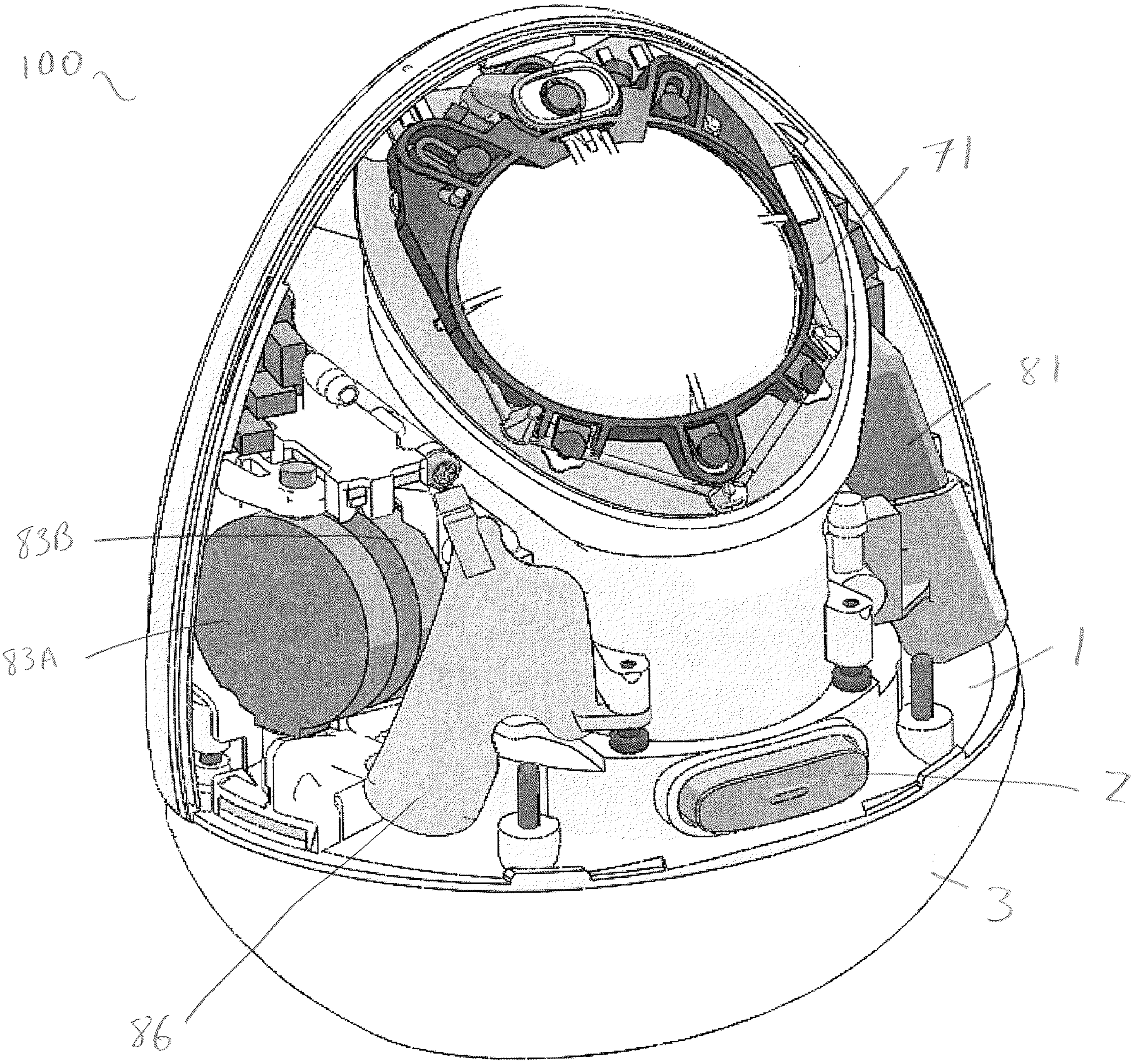
Fig. 7



7397102; JCP2; JCP2

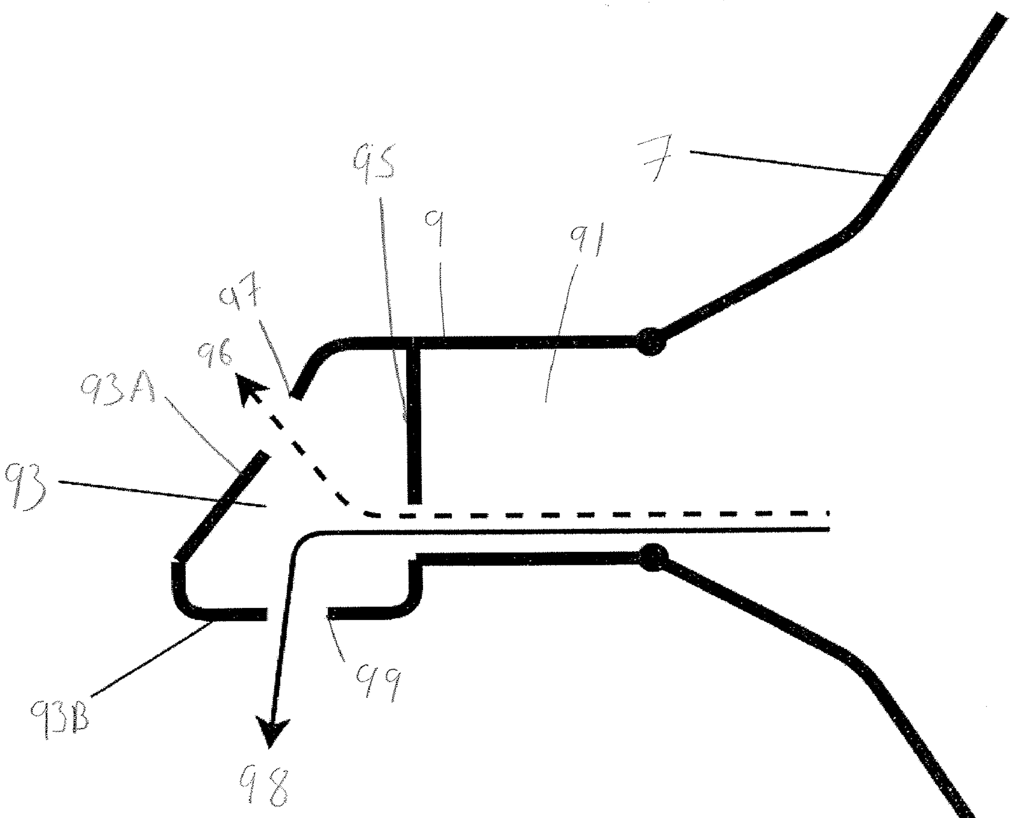
P153992GB00

Fig. 8



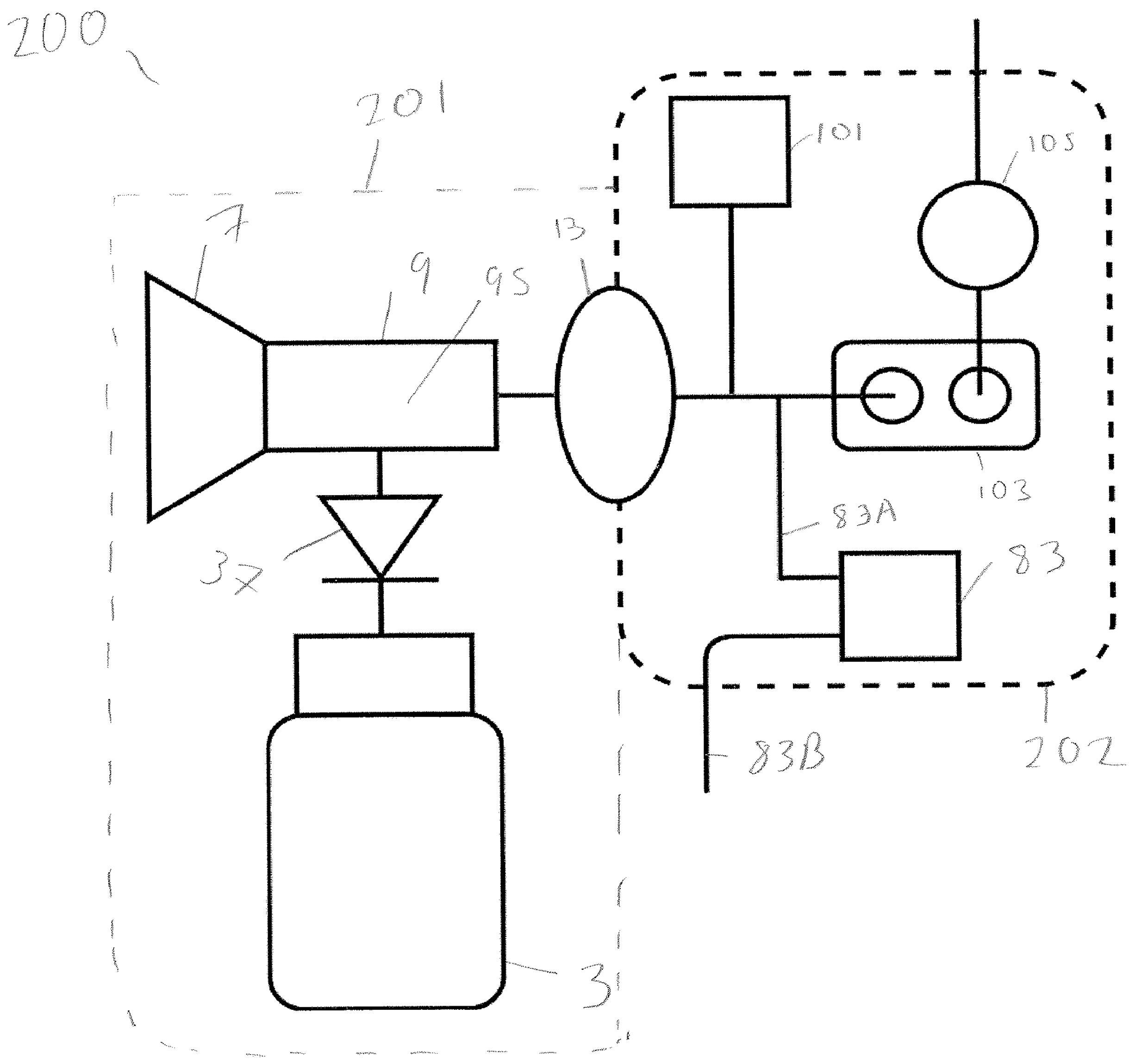
P153992GB00

Fig 9



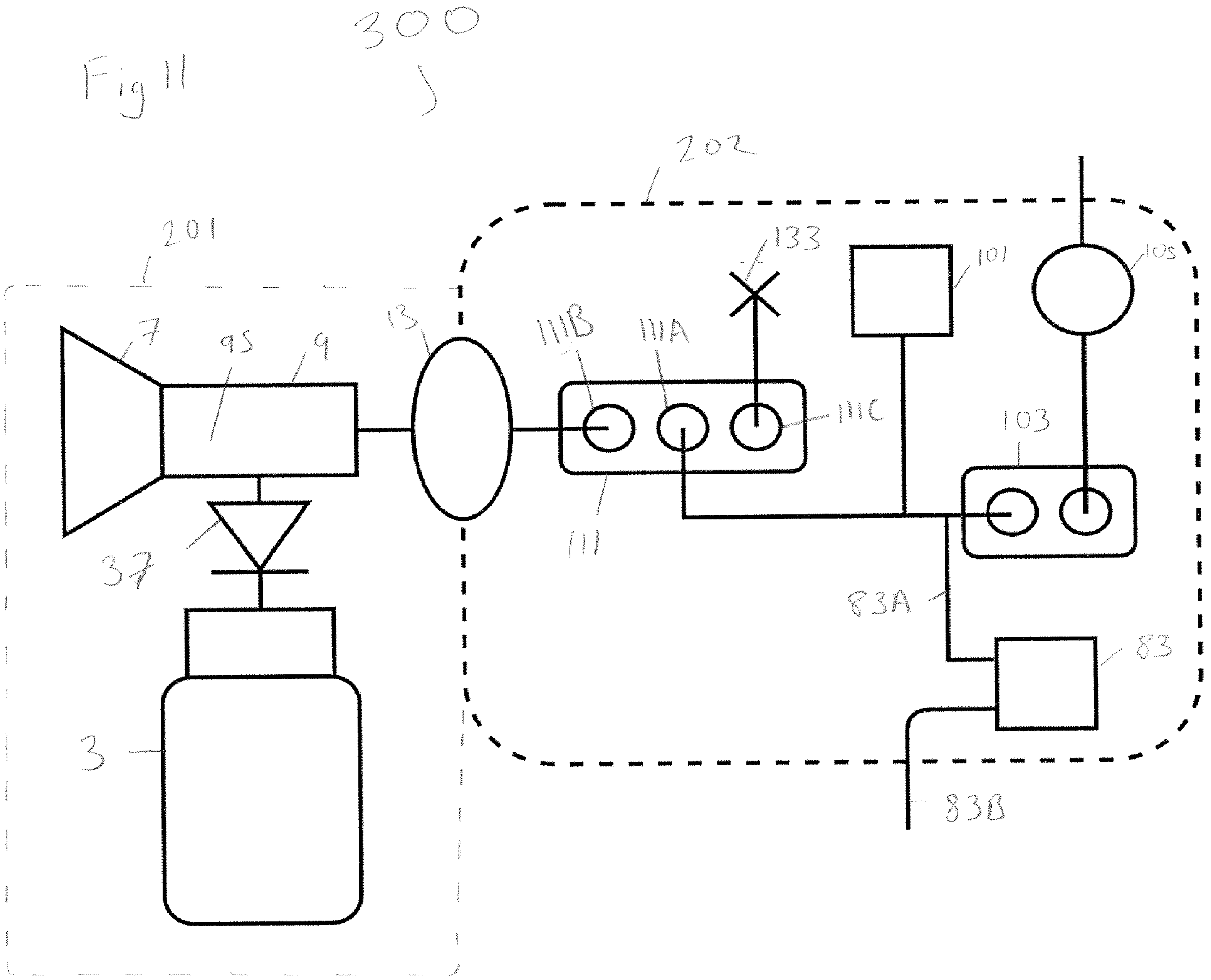
P153992GB00

Fig. 10



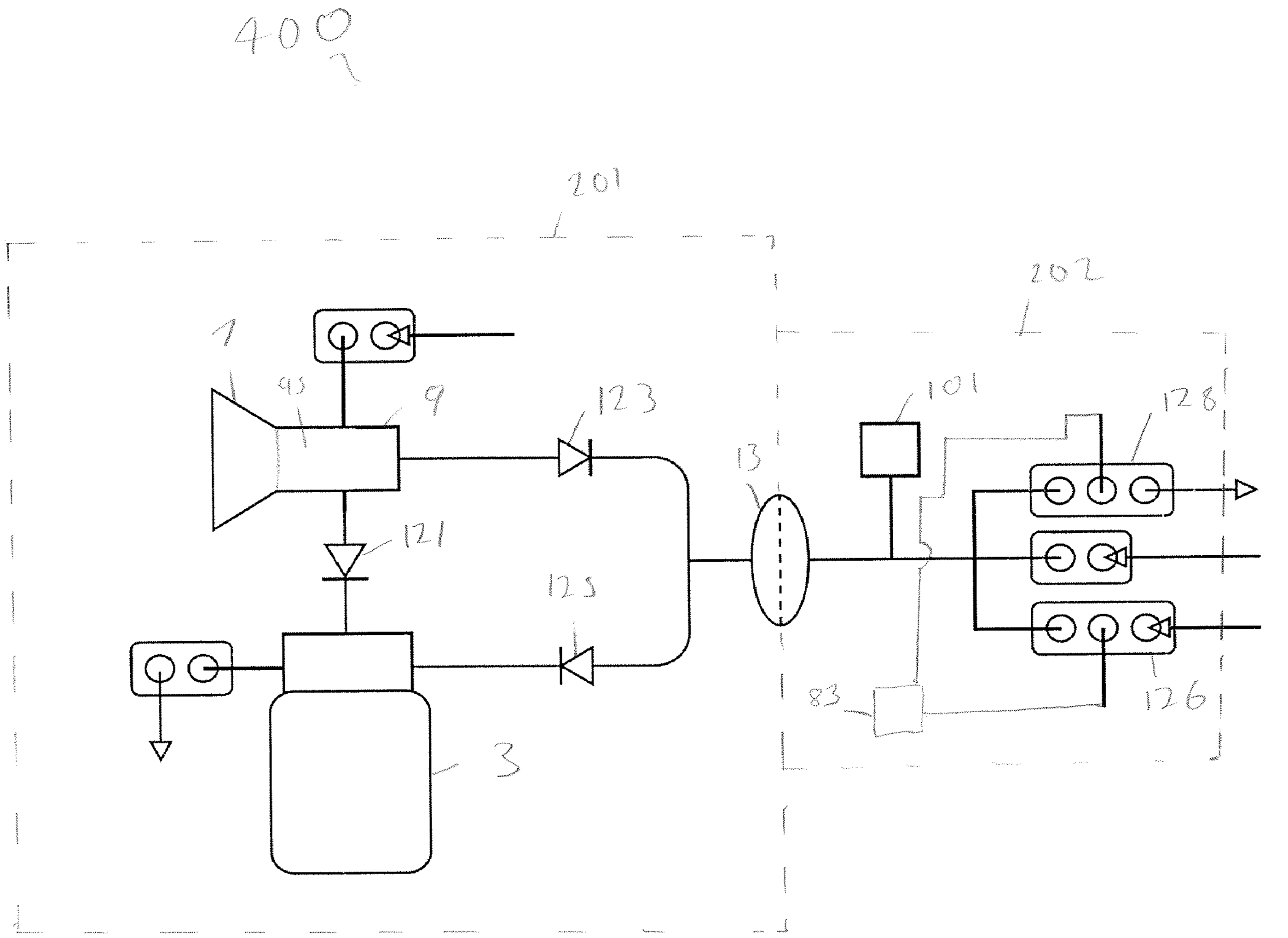
P153992GB00

Fig 11



P153992GB00

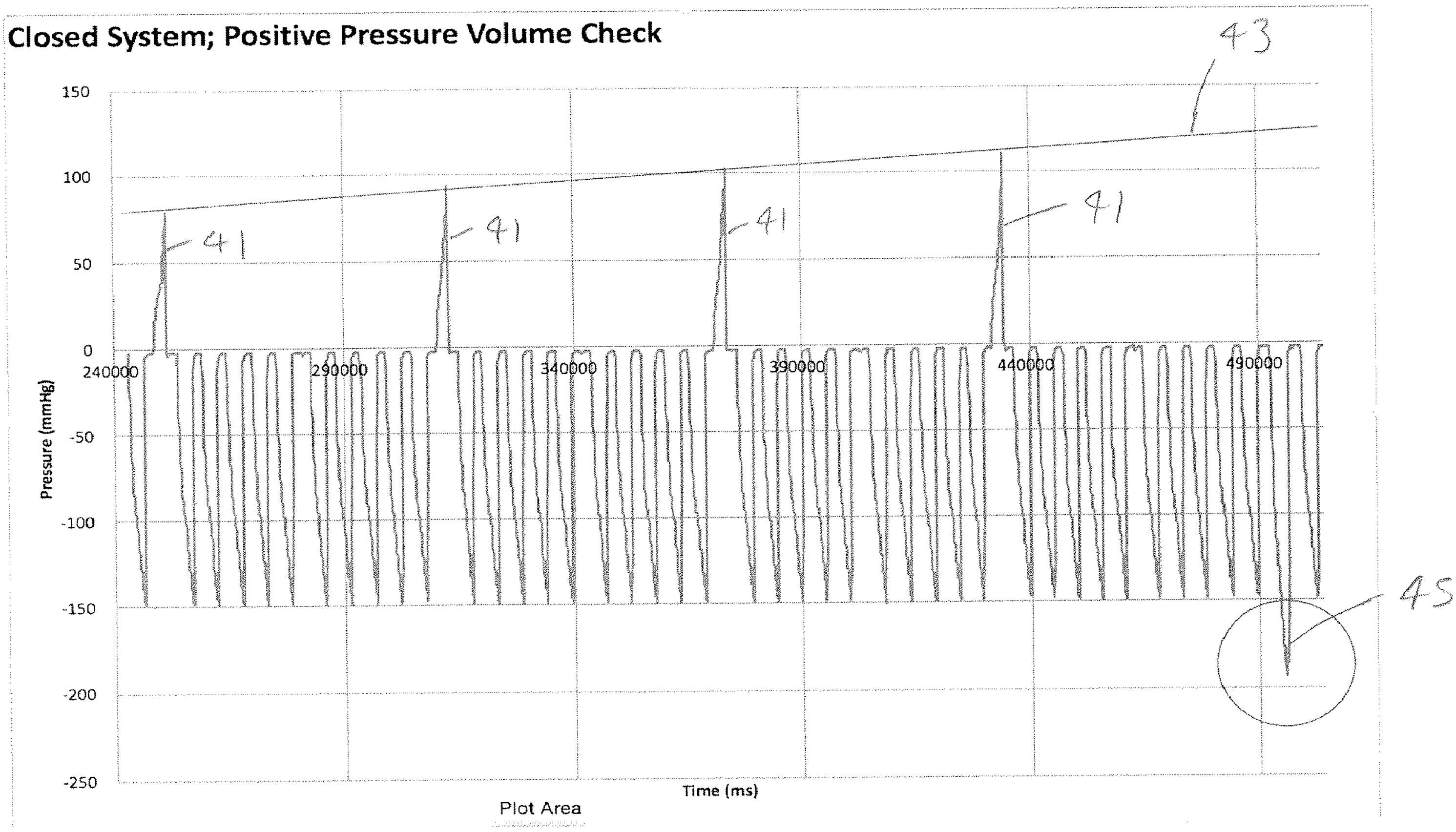
Fig. 12



13/13

P153992GB00

Fig 13



WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

Digital Access Service (DAS)

CERTIFICATE OF AVAILABILITY OF A CERTIFIED PATENT DOCUMENT IN A DIGITAL LIBRARY

The International Bureau certifies that a copy of the patent application indicated below has been available to the WIPO Digital Access Service since the date of availability indicated, and that the patent application has been available to the indicated Office(s) as of the date specified following the relevant Office code:

Document details:	Country/Office:	GB
	Filing date:	01 Jun 2018 (01.06.2018)
	Application number:	1809036.5

Date of availability of document: 13 Jul 2018 (13.07.2018)

The following Offices can retrieve this document by using the access code:
AR, AT, AU, BE, BR, CA, CL, CN, CO, DK, EA, EE, EP, ES, FI, GB, GE, IB, IL, IN, JP, KR, MA, MX, NL, NO, NZ, SE, US

Date of issue of this certificate: 26 Mar 2021 (26.03.2021)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Certified Office Copy

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with patent application GB1809036.5 filed on 01 June 2018, and as stored electronically on the Patents Electronic Case file System.

The Patents Electronic Case-file System is compliant with British Standard BS10008 - Evidential weight and legal admissibility of information stored electronically and ISO15801 - Electronic imaging – information stored electronically, recommendations for trustworthiness and reliability.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed A HAYES

Dated 07 June 2018

2018013286

01/06/2018 0.00 NONE

Intellectual Property Office

Patents Form 1
Patents Act 1977 *(Rule 12)*

Request for grant of a patent

Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

Application number GB1809036.5

1. Your reference	**Elvie Pump (UK)**
2. Full name, address and postcode of the applicant or of each applicant	**CHIARO TECHNOLOGY LIMITED** **63 - 66 Hatton Garden** **London EC1N 8LE** **United Kingdom**
Patents ADP number *(if you know it)*	11287869002
3. Title of the invention	**Breast pump system**
4. Name of your agent *(if you have one)* "Address for service" to which all correspondence should be sent. This may be in the European Economic area or Channel Islands (see warning note below) *(including the postcode)*	**Langley, Mr Peter** **Origin Limited** **Twisden Works** **Twisden Road** **London NW5 1DN** **United Kingdom**
Patents ADP number *(if you know it)*	~~09541046001~~ 11436136001
5. Priority declaration: Are you claiming priority from one or more earlier-filed patent applications? If so, please give details of the application(s)	

Country	Application number	Date of filing	PDAS Access Code

	Number of earlier UK application	Date of filing *(day / month / year)*
6. Divisionals etc: Is this application a divisional application, or being made following resolution of an entitlement dispute about an earlier application. If so, please give the application number and filing date of the earlier application		

7. Inventorship: (Inventors must be individuals not companies) Are all the applicants named above also inventors?	**No**
8. Are you paying the application fee with this form?	**No**

9. Accompanying documents: please enter the number of pages of each item accompanying this form.

Continuation sheets of this form

Description:	**121**
Claim*(s)*:	**n/a**
Abstract:	**n/a**
Drawing*(s)*:	**44**

If you are not filing a description, please give details of the previous application you are going to rely upon

Country	Application number	Date of filing	PDAS Access Code

10. If you are also filing any of the following, state how many against each item.

Priority documents:	**0**
Statement of inventorship and right to grant of a patent (Patents Form 7):	**0**
Request for search (Patents Form 9A):	**0**
Request for substantive examination (Patents Form 10):	**0**
Any other documents (please specify):	**PDAS Registration Form**

11. I/We request the grant of a patent on the basis of this application.

Date: **01 Jun 2018**

12. Name, e-mail address, telephone, fax and/or mobile number, if any, of a contact point for the applicant

Langley, Mr Peter
Email: roland@origin.co.uk
Telephone: 02074241952
Fax: 02072090643

Warning
After an application for a patent has been filed, the Comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you are resident in the United Kingdom and your application contains information which relates to military technology, or would be prejudicial to national security or the safety of the public, section 23 of the Patents Act 1977 prohibits you from applying for a patent abroad without first getting written permission from the Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked. Until such time or until the revocation of any direction, for any such application the address for service referred to at part 4 above must be in the United Kingdom.

Although you may have an address for service in the Channel Islands, any agent instructed to act for you must reside or have a place of business in the European Economic Area or Isle of Man.

BREAST PUMP SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of the invention relates to a breast pump system; one implementation of the system is a wearable, electrically powered breast pump system for extracting milk from a mother.

2. Description of the Prior Art

The specification of the present disclosure is broad and deep. We will now describe the prior art in relation to key aspects of the present disclosure.

Prior art related to breast pump systems

A breast pump system is a mechanical or electro-mechanical device that extracts milk from the breasts of a lactating woman.

A typical breast pump design is as shown in WO 96/25187 A1. A large suction generating device is provided, which is freestanding. This is attached by air lines to one or two breast shields which engage with the user's breasts. A pressure cycle is applied from the suction generating device, via the air lines, to the breast shields. This generates a pressure cycle on the user's breasts to simulate the suction generated by a feeding child.

The suction generating device is a large component that connects to mains power to operate the pumps therein. Milk collection bottles are provided to store the expressed

breast milk. In the system of WO 96/36298 A1 separate bottles are provided attached to each breast shield. A single bottle with tubing connecting to each breast shield may also be used. But for a mother to use this discretely, such as in an office environment, specialised bras must be used. In particular, breast-pumping bras which have a central slit, for the nipple tunnel of the breast shield to extend through, are typically used. The breast shield is held within the bra, with the suction generating device and milk bottle outside the bra.

The fundamental breast pump system has not significantly evolved from this approach, only minor technical improvements have been made.

However, these systems present a number of significant disadvantages. As the suction generating device is a large freestanding unit connected to mains power, the user may feel tethered to the wall. The known devices typically also require a specific user posture and undressing to function normally. This is obviously difficult for a user to do discretely, such as in an office setting. The known devices are also typically noisy, uncomfortable, and hard to clean.

Fully integrated wearable breast pump systems have begun to enter the market, such as described in US 2016 0206794 A1. In such pump systems, the suction source, power supply and milk container are contained in a single, wearable device; there is no need for bulky external components or connections. Such devices can be provided with a substantially breast shaped convex profile so as to fit within a user's bra for discrete pumping, as well as pumping on-the-go without any tethers to electrical sockets or collection stations. The internal breast shield is naturally convex to fit over a breast.

In US 2016 0206794 A1, when viewed from the front, the breast pump device has a 'tear-drop' rounded shape, fuller at its base than at its top. But it uses collapsible bags as milk collection devices. As the collection bag systems are collapsible, it can be difficult for a user to extract all of their milk from the bag, due to the small cut opening that is needed and the capillary action between the bonded plastic sheets that form the bag. This waste can be disheartening for the user, as this is food for their child. The bags are also not re-usable, so the user is required to purchase and maintain a stock of these. As well as presenting a recurring cost, if the user runs out of stock they are unable to use the

product until more bags are purchased.

Furthermore, as a result of the collapsible bags, a complex and somewhat noisy pumping arrangement is necessary. In particular, the breast shield connects to a tube which is provided with compression units which "step" the expressed milk through the tube to the collection bag. This uses the breast milk as a hydraulic fluid to generate suction on the breast. In order to carry this out, a complex sequenced pulsing arrangement must be implemented.

In addition to these systems being particularly complex and wasteful, only a relatively small bag can be used. In US 2016 206794, approximately 110 ml (4 fluid ounces) of milk can be collected before the bag must be changed. While this may be sufficient for some users, others may produce much more milk in a session.

A further integrated wearable breast pump system is shown in US 2013 0023821 A1. In the third embodiment in this document, the breast pump system includes a motor driven vacuum pump and power source. An annular (or punctured disc) membrane is provided, with the flow path of the milk going through the centre of the annulus. The membrane is housed in separate housing and is sealed at its inner and outer edges. The breast shield has a small protrusion to engage with these housing components. However, the design of this breast pump system results in a number of problems. The use of an annular membrane, with the fluid flow path running through the opening of the annulus is undesirable as it results in a large and bulky device. There is therefore a need for improved integrated breast pump systems.

Prior Art related to liquid measurement systems

In the context of breast pump systems, it is useful to measure the quantity of expressed milk. One way to do this is to have a clear container for the breast pump, through which the level of expressed milk inside the container can be seen. However, viewing the milk bottle is not always possible, for example in a breast pump that collects milk while being worn inside a maternity bra.

An existing apparatus for detecting the level of liquid inside a container of a breast pump is that disclosed in US 2016/296681. In this apparatus, a sensing mechanism is provided

at the top of a container, which detects droplets of liquid, specifically breast milk, entering the container. By detecting these droplets entering the container, the apparatus can determine the quantity of liquid which enters the container. In this apparatus, an accurate indication of the level of liquid in the container is reliant on the sensing mechanism being able to accurately record every droplet entering the container.

Particularly at times when liquid enters the container at a high flow rate, this accuracy cannot be guaranteed, leading to significant cumulative errors. An accurate indication of the level of liquid in the container in this apparatus is also reliant on the sensing mechanism always being on during the pumping process, so that power consumption of the sensing mechanism is correspondingly high.

In view of the above, there is the need for an improved way to determine the level of liquid inside a container connected to a breast pump.

Prior Art related to bra clips

Many specialised bras (or brassieres) exist for maternity use and that facilitate nursing and/or breast pumping for milk collection, without the need to remove the bra itself. In a traditional nursing bra, this is achieved with the use of an at least partially detachable cup, which can be unhooked for feeding and/or pumping.

Further specialised bras are known which are provided with cut-out portions or slits which substantially align with the wearer's areola and nipple. Traditional breast pump systems comprise an elongate breast shield which extends away from the breast towards an external bottle and source of suction. The breast shield is arranged to extend through the cut-out portion or slit, with the collection bottle and pumping apparatus placed outside of the bra. These systems require the user to remove or unbutton any over-garments, and are uncomfortable when not pumping.

Integrated, wearable breast pump systems have begun to enter the market, such as previously noted US 2016 0206794 A1. In such pumps, the suction source, power supply and milk container are all in a single, wearable device, as noted above, without the need for bulky external components or connections. Such devices can be provided with a substantially breast shaped profile so as to fit within a user's bra for discrete pumping, as

well as pumping on-the-go without any tethers to electrical sockets or collection stations.

Maternity (or nursing) bras such as disclosed in US 4,390,024 A have partially detachable cups, with several hooks provided along the bra strap for attaching the cups to the strap. The cups can then be attached to different hooks in order to adjust the bra strap length. However, these attachment points are fixed. Additionally, this bra has been designed to accommodate the change in breast size before and after the feeding/pumping process. It is not designed to accommodate a breast pump. Accordingly, there is a need for a better system to accommodate integrated wearable breast pumps.

SUMMARY OF THE INVENTION

The invention is a wearable breast pump system including: a housing shaped at least in part to fit inside a bra and including a pumping mechanism; a breast shield; a rigid or non-collapsible milk container; and in which the breast pump system includes only two parts that are directly removable from the housing in normal use or normal dis-assembly: the breast shield and the rigid, non-collapsible milk container.

BRIEF DESCRIPTION OF THE FIGURES

Aspects of the invention will now be described, by way of example(s), with reference to the following Figures, which each show features of various implementations of the invention including optional features that may be utilised:

Figure 1 is a front view of an assembled breast pump system.

Figure 2 is a rear view of the assembled breast pump system of Figure 1.

Figure 3 is a front view of a partially disassembled breast pump system.

Figure 4 is a rear view of the partially disassembled breast pump system of Figure 3.

Figure 5 is a front view of a further partially disassembled breast pump system.

Figure 6 is a rear view of the further partially disassembled breast pump system of Figure 5.

Figure 7 is a front view of the breast pump system of Figure 1, with the outer shell translucent for ease of explanation.

Figure 8 is a further front view of the breast pump system of Figure 1, with the front of the outer shell removed for ease of explanation.

Figure 9 is a schematic view of a nipple tunnel for a breast shield.

Figure 10 is a schematic of a pneumatic system for a breast pump system.

Figure 11 is a schematic of an alternative pneumatic system for a breast pump system.

Figure 12 is a schematic of a further alternative pneumatic system for a breast pump system.

Figure 13 is a graph depicting measured pressure in the breast pump system of Figure 12 over time.

Figure 14 shows schematics for breast shield sizing and nipple alignment.

Figure 15 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 16 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 17 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 18 shows a screenshot of an application running on a device connected to the breast pump system.

Figure 19 shows a screenshot of an application running on a device connected to the

breast pump system.

Figure 20 shows a screenshot of an application running on a connected device.

Figure 21 shows a screenshot of an application running on a connected device.

Figure 22 shows a screenshot of an application running on a connected device.

Figure 23 shows a screenshot of an application running on a connected device.

Figure 24 shows a screenshot of an application running on a connected device.

Figure 25 shows a screenshot of an application running on a connected device.

Figure 26 shows a diagram of a breast pump sensor network,

Figure 27 shows a sectional view of a device being used to determine the level of liquid in a container;

Figure 28 shows a sectional view of the device and the container from Figure 27 being used at a different orientation.

Figure 29 shows a sectional view of the device and the container from Figure 27 being used whilst undergoing acceleration.

Figure 30 shows a sectional view of the device from Figure 27 being used as part of a breast pump assembly.

Figure 31 shows a sectional view of a device connected between a container and its lid, and which is operable to determine the level of liquid inside the container.

Figure 32 depicts a prior art design for a maternity bra;

Figure 33 depicts a clip and clasp being fitted to a maternity bra.

Figure 34 depicts an alternative clip for adjustment of a maternity bra.

Figure 35 depicts the alternative clip of Figure 34.

Figure 36 depicts an alternative clip for adjustment of a maternity bra.

Figure 37 depicts an alternative clip for adjustment of a maternity bra.

Figure 38 depicts an alternative clip for adjustment of a maternity bra.

Figure 39 depicts adjustment of the maternity bra of Figure 37.

Figure 40 shows a configuration with two piezo pumps mounted in series.

Figure 41 shows a configuration of two piezo pumps mounted in parallel.

Figure 42 shows a plot of the air pressure generated as a function of time by two piezo pumps mounted in series and mounted in parallel respectively.

Figure 43 shows a plot of the air pressure generated as a function of time by two piezo pumps mounted in a dual configuration.

Figure 44 shows a figure of a pump including two piezo pumps in which each piezo pump is connected to a heat sink.

DETAILED DESCRIPTION

We will now describe an implementation of the invention, called the Elvie™ pump, in the following sections:

Section A: The Elvie™ Breast Pump System
Section B: An IR System
Section C: A Bra Clip
Section D: Piezo Pumps and Wearable Devices

Section A: The Elvie™ Breast Pump System

1. Elvie™ Breast Pump System Overview

An implementation of the invention, called the Elvie™ pump, is a breast pump system that is, at least in part, wearable inside a bra. The breast pump system comprises a breast shield for engagement with the user's breast, a housing for receiving at least a portion of the breast shield and a detachable rigid milk collection container attachable, in use, to a lower face of the housing and connected to the breast shield for collecting milk expressed by the user, with a milk-flow pathway defined from an opening in the breast shield to the milk collection container. The housing inside also includes a pump for generating a negative pressure in the breast shield, as well as battery and control electronics Unlike other wearable breast pumps, the only parts of the system that come into contact with milk in normal use are the breast shield and the milk container; milk only flows through the breast shield and then directly into the milk container. Milk does not flow through any parts of the housing at all, for maximum hygiene and ease of cleaning.

With reference to Figure 1 and Figure 2, the assembled breast pump system 100 includes a housing 1 shaped to substantially fit inside a bra. The housing 1 includes one or more pumps and a rechargeable battery. The breast pump system includes two parts that are directly connected to the housing 1: the breast shield 7 and a milk container 3. The breast shield 7 and the milk container 3 are directly removable or attachable from the housing 1 in normal use or during normal dis-assembly (most clearly shown in Figure 5). All other parts that are user-removable in normal use or during normal dis-assembly are attached to either the breast shield 7 or the milk container 3. The breast shield 7 and milk container 3 may be removed or attached for example using a one click or one press action or a push button or any other release mechanism. Audible and/or haptic feedbacks confirm that the pump is properly assembled.

The modularity of the breast pump allows for easy assembly, disassembly and replacement of different parts such as the breast shield and milk collection container. This also allows for different parts of the pump to be easily washed and/or sterilised. The breast shield and bottle assembly, both of which are in contact with milk during

pumping, may therefore be efficiently and easily cleaned; these are the only two items that need to be cleaned; in particular, the housing does not need to be cleaned.

The housing 1, breast shield 7 that is holding a flexible diaphragm, and milk container 3 attach together to provide a closed-loop pneumatic system powered by piezoelectric pumps located in the housing 1. This system then applies negative pressure directly to the nipple, forms an airtight seal around the areola, and provides a short path for expressed milk to collect in an ergonomically shaped milk container 3.

The different parts of the breast shield system are also configured to automatically self-seal under negative pressure for convenience of assembly and disassembly and to reduce the risk of milk spillage. Self-sealing refers to the ability of sealing itself automatically or without the application of adhesive, glue, or moisture (such as for example a self-sealing automobile tire or self-sealing envelopes). Hence once the breast pump system is assembled it self-seals under its assembled condition without the need to force seals into interference fits to create sealed chambers. A degree of interference fitting is usual however, but is not the predominating attachment mechanism. Self-sealing enables simple components to be assembled together with a light push: for example, the diaphragm just needs to be placed lightly against the diaphragm housing; it will self-seal properly and sufficiently when the air-pump applies sufficient negative air-pressure. The diaphragm itself self-seals against the housing when the breast shield is pushed into the housing. Likewise, the breast shield self-seals against the milk container when the milk container is pushed up to engage the housing. This leads to simple and fast assembly and dis-assembly, making it quick and easy to set the device up for use, and to clean the device after a session.

Self-sealing has a broad meaning and may also relate to any, wholly or partly self-energising seals. It may also cover any interference seals, such as a press seal or a friction seal, which are achieved by friction after two parts are pushed together.

Whilst one particular embodiment of the invention's design and a specific form of each of the parts of the breast pump system is detailed below, it can be appreciated that the overall description is not restrictive, but an illustration of topology and function that the design will embody, whilst not necessary employing this exact form or number of

discrete parts.

The breast pump system 100 comprises a housing 1 and a milk collection container (or bottle) 3. The housing 1 (including the one or more pumps and a battery) and the container 3 are provided as a unit with a convex outer surface contoured to fit inside a bra. The milk collection container 3 is attached to a lower face 1A of the housing 1 and forms an integral part of the housing when connected, such that it can be held comfortably inside a bra. While the breast pump 100 may be arranged to be used with just the right or the left breast specifically, the breast pump 100 is preferably used with both breasts, without modification. To this end, the outer surfaces of the breast pump 100 are preferably substantially symmetrical.

Preferably, the width of the complete breast pump device (housing 1 and milk container 3) is less than 110 mm and the height of the complete breast pump device is less than 180 mm.

Overall, the breast pump system 100 gives discrete and comfortable wear and use. The system weighs about 224 grams when the milk container is empty, making it relatively lighter as compared to current solutions; lightness has been a key design goal from the start, and has been achieved through a lightweight piezo pump system and engineering design focussed on minimising the number of components.

The breast pump system 100 is small enough to be at least in part held within any bra without the need to use a specialized bra, such as a maternity bra or a sports bra. The rear surface of the breast pump is also concave so that it may sit comfortably against the breast. The weight of the system has also been distributed to ensure that the breast pump is not top heavy, ensuring comfort and reliable suction against the breast. The centre of gravity of the pump system is, when the container is empty, substantially at or below the horizontal line that passes through the filling point on the breast shield, so that the device does not feel top-heavy to a person while using the pump.

Preferably, when the container is empty, the centre of gravity is substantially at or below the half-way height line of the housing so that the device does not feel top-heavy to a user using the pump.

The centre of gravity of the breast pump, as depicted by Figure 1, is at around 60mm high on the centreline from the base of the breast pump when the milk container is empty. During normal use, and as the milk container gradually receives milk, the centre of gravity lowers, which increases the stability of the pump inside the bra. It reduces to around 40mm high on the centreline from the base of the breast pump when the milk container is full.

The centre of gravity of the breast pump is at about 5.85mm below the centre of the nipple tunnel when the milk container is empty, and reduced to about 23.60mm below the centre of the nipple tunnel when the milk container is full. Generalising, the centre of gravity should be at least 2mm below the centre of the nipple tunnel when the container is empty.

The breast pump 100 is further provided with a user interface 5. This may take the form of a touchscreen and/or physical buttons. In particular, this may include buttons, sliders, any form of display, lights, or any other componentry necessary to control and indicate use of the breast pump 100. Such functions might include turning the breast pump 100 on or off, specifying which breast is being pumped, increasing or decreasing the peak pump pressure. Alternatively, the information provided through the user interface 5 might also be conveyed through haptic feedback, such as device vibration, driven from a miniature vibration motor within the pump housing 1.

In the particular embodiment of the Figures, the user interface 5 comprises power button 5A for turning the pump on and off. The user interface 5 further comprises pump up button 5B and pump down button 5C. These buttons adjust the pressure generated by the pump and hence the vacuum pressure applied to the user's breast. In preferable embodiments, the pump up button 5B could be physically larger than the pump down button 5C. A play/pause button 5D is provided for the user to interrupt the pumping process without turning the device off.

The user interface 5 further comprises a breast toggle button 5E for the user to toggle a display of which breast is being pumped. This may be used for data collection, e.g. via an application running on a connected smartphone; the app sends data to a remote server, where data analysis is undertaken (as discussed in more detail later), or for the user to keep track of which breast has most recently been pumped. In particular, there may be a

pair of LEDs, one to the left of the toggle button 5E and one to the right. When the user is pumping the left breast, the LED to the right of the toggle button 5E will illuminate, so that when the user looks down at the toggle it is the rightmost LED from their point of view that is illuminated. When the user then wishes to switch to the right breast, the toggle button can be pressed and the LED to the left of the toggle button 5E, when the user looks down will illuminate. The connected application can automatically track and allocate how much milk has been expressed, and when, by each breast.

The breast pump system also comprises an illuminated control panel, in which the level of illumination can be controlled at night or when stipulated by the user. A day time mode, and a less bright night time mode that are suitable to the user, are available. The control of the illumination level is either implemented in hardware within the breast pump system itself or in software within a connected device application used in combination with the breast pump system.

As depicted in Figure 1, the housing 1 and milk collection container 3 form a substantially continuous outer surface, with a generally convex shape. This shape roughly conforms with the shape of a 'tear-drop' shaped breast. This allows the breast pump 100 to substantially fit within the cup of a user's bra. The milk collection container 3 is retained in attachment with the housing 1 by means of a latch system, which is released by a one-click release mechanism such as a push button 2 or any other one-handed release mechanism. An audible and/or haptic feedback may also be used to confirm that the milk collection container 3 has been properly assembled.

The European standard EN 13402 for Cup Sizing defines cup sizes based upon the bust girth and the underbust girth of the wearer and ranges from AA to Z, with each letter increment denoting an additional 2 cm difference. Some manufacturers do vary from these conventions in denomination, and some maternity bras are measured in sizes of S, M, L, XL, etc. In preferred embodiments, the breast pump 100 of the present invention corresponds to an increase of between 3 or 4 cup sizes of the user according to EN 13402.

A plane-to-plane depth of the breast pump can also be defined. This is defined as the distance between two parallel planes, the first of which is aligned with the innermost

point of the breast pump 100, and the second of which is aligned with the outermost point of the breast pump 100. This distance is preferably less than 100 mm.

Figure 2 is a rear view of the breast pump 100 of Figure 1. The inner surface of the housing 1 and milk collection container 3 are shown, along with a breast shield 7. The housing 1, milk collection container 3 and breast shield 7 form the three major subcomponents of the breast pump system 100. In use, these sub-components clip together to provide the functioning breast pump system 100. The breast shield 7 is designed to engage with the user's breast, and comprises a concave inner flange 7A which contacts the breast. To allow the breast pump 100 to be used on either of the user's breasts, the breast shield 7 is preferably substantially symmetrical on its inner flange 7A.

The inner flange 7A is substantially oval-shaped. While the inner flange 7A is concave, it is relatively shallow such that it substantially fits the body form of the user's breast. In particular, when measured side-on the inner-most point of the flange 7A and the outer-most point may be separated by less than 25 mm. By having a relatively shallow concave surface, the forces applied can be spread out over more surface area of the breast. The flatter form also allows easier and more accurate location of the user's nipple. In particular, the flange 7A of the breast shield 7 may extend over the majority of the inner surface of the housing 1 and milk collection container 3. Preferably, it may extend over 80% of this surface. By covering the majority of the inner surface, the breast shield is the only component which contact's the wearer's breast. This leaves fewer surfaces which require thorough cleaning as it reduces the risk of milk contacting a part of the device which cannot be easily sterilized. Additionally, this also helps to disperse the pressure applied to the user's breast across a larger area.

The breast shield 7 substantially aligns with the outer edge 1B of the housing 1. The milk collection container 3 may be provided with an arcuate groove for receiving a lower part of the breast shield 7. This is best shown in later Figures. In the assembled arrangement of Figures 1 and 2, the inner surface of the breast pump 100 is substantially continuous.

The breast shield 7 comprises a shield flange for engaging the user's breast, and an elongate nipple tunnel 9) aligned with the opening and extending away from the user's

breast. Breast shield nipple tunnel 9 extends from a curved section 7B in the breast shield 7. In preferable embodiments the nipple tunnel 9 is integral with the breast shield 7. However, it is appreciated that separate removable/interchangeable nipple tunnels may be used. Curved section 7B is positioned over the user's nipple and areola in use. The breast shield 7 forms an at least partial seal with the rest of the user's breast around this portion, under the negative air pressure created by an air-pressure pump.

This breast shield nipple tunnel 9 defines a milk-flow path from the inner surface of the breast shield 7A, through the breast shield nipple tunnel 9 and into the milk collection container 3. The breast shield nipple tunnel 9 is preferably quite short in order to minimise the length of the milk-flow path in order to minimise losses. By reducing the distance covered by the milk, the device is also reduced in size and complexity of small intermediate portions. In particular, the breast shield nipple tunnel 9 may extend less than 70 mm from its start to end, more preferably less than 50 mm. In use, the nipple tunnel 9 is substantially aligned with the user's nipple and areolae. The nipple tunnel comprises a first opening 9A for depositing milk into the collection container and a second opening 19A for transferring negative air pressure generated by the pump to the user's nipple.

The shield flange 7A and nipple tunnel 9 may be detachable from the housing 1 together. The shield flange 7A and nipple tunnel 9 being detachable together helps further simplify the design, and reduce the number of components which must be removed for cleaning and sterilization. However, preferably, the nipple tunnel 9 will be integral with the breast shield 7, in order to simplify the design and reduce the number of components which must be removed for cleaning and sterilisation.

Figures 3 and 4 are of a partially disassembled breast pump 100 of the present invention. In these Figures, the breast shield 7 has been disengaged from the housing 1 and milk collection bottle 3. As shown in Figure 4, the housing 1 comprises a region or slot 11 for receiving the breast shield nipple tunnel 9 of the breast shield 7. The breast shield is held in place thanks to a pair of channels (9B) included in the nipple tunnel 9, each channel including a small indent. When pushing the housing 1 onto the breast shield 7, which has been placed over the breast, ridges in the housing (9C) engage with the channels, guiding the housing into position; a small, spring plunger, such as ball bearing in each

ridge facilitates movement of the housing on to the nipple tunnel 9. The ball bearings locate into the indent to secure the housing on to the nipple tunnel with a light clicking sound. In this way, the user can with one hand place and position the breast shield 7 onto her breast and with her other hand, position and secure the housing 1 on to the breast shield 7. The breast shield 7 can be readily separated from the housing 1 since the ball bearing latch only lightly secures the breast shield 7 to the housing 1.

Alternatively, the breast shield 7 may also be held in place by means of a clip engaging with a slot located on the housing. The clip may be placed at any suitable point on the shield 7, with the slot in a corresponding location.

The breast shield nipple tunnel 9 of the breast shield 7 is provided with an opening 9A on its lower surface through which expressed milk flows. This opening 9A is configured to engage with the milk collection bottle 3.

The breast pump 100 further comprises a barrier or diaphragm for transferring the pressure from the pump to the milk-collection side of the system. In the depicted example, this includes flexible rubber diaphragm 13 seated into diaphragm housing 19A. The barrier could be any other suitable component such as a filter or an air transmissive material. Diaphragm housing 19A includes a small air hole into the nipple tunnel 9 to transfer negative air pressure into nipple tunnel 9 and hence to impose a sucking action on the nipple placed in the nipple tunnel 9.

Hence, the air pump acts on one side of the barrier or diaphragm 13 to generate a negative air pressure on the opposite, milk-flow side of the barrier. The barrier has an outer periphery or surface, i.e. the surface of diaphragm housing 19A that faces towards the breast, and the milk-flow pathway extends underneath the outer periphery or surface of the barrier or diaphragm housing 19A. The milk-flow path extending under the outer periphery or surface of the barrier 19A allows for a simpler and more robust design, without the milk-flow pathway extending through the barrier. This provides increased interior space and functionality for the device.

As noted, the milk-flow pathway extends beneath or under the barrier 13 or surface of diaphragm housing 19A. This provides an added benefit of having gravity move the milk down and away from the barrier.

Preferably the milk-flow pathway does not pass through the barrier 32. This results in a simpler and smaller barrier design.

As noted, the diaphragm 13 is mounted on diaphragm housing 19A that is integral to the breast shield. This further helps increase the ease of cleaning and sterilisation as all of the components on the "milk" flow side can be removed.

The barrier 13 may also provide a seal to isolate the air pump from the milk-flow side of the barrier. This helps to avoid the milk becoming contaminated from the airflow or pumping side (i.e. the non-milk-flow side).

Alternatively, the only seal is around an outer edge of the barrier 13. This is a simple design as only a single seal needs to be formed and maintained. Having multiple seals, such as for an annular membrane, introduces additional complexity and potential failure points.

As illustrated in Figures 3 and 4, the barrier may include a flexible diaphragm 13 formed by a continuous circular disc shaped membrane which is devoid of any openings or holes. This provides a larger effective "working" area of the diaphragm (i.e. the area of the surface in contact with the pneumatic gasses) than an annular membrane and hence the membrane may be smaller in diameter to have the same working area.

The diaphragm 13 is arranged so that the milk-flow pathway extends below and past the outer surface or periphery of the diaphragm 13. This means that the milk-flow pathway does not extend through the diaphragm 13. In particular, the milk-flow pathway is beneath the diaphragm 13. However, the diaphragm 13 may be offset in any direction with respect to the milk-flow pathway, provided that the milk-flow pathway does not extend through the diaphragm 13.

Preferably, the diaphragm 13 is a continuous membrane, devoid of any openings. The diaphragm 13 is held in a diaphragm housing 19, which is formed in two parts. The first half 19A of the diaphragm housing 19 is provided on the outer surface of the breast shield 7, above the breast shield nipple tunnel 9 and hence the milk-flow pathway. In

preferred embodiments, the first half 19A of the diaphragm housing 19 is integral with the breast shield. The second half 19B of the diaphragm housing is provided in a recessed portion of the housing 1. The diaphragm 13 self-seals in this diaphragm housing 19 around its outer edge, to form a watertight and airtight seal. Preferably, the self-seal around the outer edge of the diaphragm 13 is the only seal of the diaphragm 13. This is beneficial over systems with annular diaphragms which must seal at an inner edge as well. Having the diaphragm 13 mounted in the breast pump 100 in this manner ensures that it is easily accessible for cleaning and replacement. It also ensures that the breast shield 7 and diaphragm 13 are the only components which need to be removed from the pump 100 for cleaning. Because the diaphragm 13 self-seals under vacuum pressure, it is easily removed for cleaning when the device is turned off.

Figures 5 and 6 show a breast pump 100 according to the present invention in a further disassembled state. In addition to the breast shield 7 and diaphragm 13 being removed, the milk collection container 3 has been unclipped. Preferably, the milk collection container 3 is a substantially rigid component. This ensures that expressed milk does not get wasted, while also enhancing re-usability. In some embodiments, the milk collection container 3 may be formed of three sections: a front bottle potion, a rear bottle potion, and a cap. These three sections may clip together to form the milk collection container 3. This three-part system is easy to empty, easily cleanable since it can be dis-assembled, and easily re-usable. The milk collection container or milk bottle may be formed of at least two rigid sections which are connectable. This allows simple cleaning of the container for re-use. Alternatively, the container may be a single container made using a blow moulding construction, with a large opening to facilitate cleaning. This large opening is then closed with a cap with an integral spout 35 or 'sealing plate' (which is bayonet-mounted and hence more easily cleaned than a threaded mount spout). A flexible rubber valve 37 (or 'sealing plate seal') is mounted onto the cap or spout 35 and includes a rubber duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump; this ensures that negative air-pressure does not need to be applied to the milk container and hence adds to the efficiency of the system. The flexible valve 37 self-seals against opening 9A in nipple tunnel 9. Because it self-seals under vacuum pressure, it automatically releases when the system is off, making it easy to remove the milk container.

Preferably, the milk collection container resides entirely below the milk flow path defined by the breast shield when the breast pump system 100 is positioned for normal use, hence ensuring fast and reliable milk collection.

The milk collection container 3 has a capacity of approximately 5 fluid ounces (148 ml). Preferably, the milk collection container has a volume of greater than 120 ml. More preferably, the milk collection container has a volume of greater than 140 ml. To achieve this, the milk collection container 3 preferably has a depth in a direction extending away from the breast in use, of between 50 to 80 mm, more preferably between 60 mm to 70 mm, and most preferably between 65 mm to 68 mm.

The milk collection container 3 further preferably has a height, extending in the direction from the bottom of the container 3 in use to the cap or spout or sealing plate 35, of between 40 mm to 60 mm, more preferably between 45 mm to 55 mm, and most preferably between 48 mm to 52 mm. The cap 35 may screw into the milk collection bottle 3. In particular, it may be provided with a threaded connection or a bayonet and slot arrangement.

Further preferably, the milk collection container has a length, extending from the leftmost point to the rightmost point of the container 3 in use, of between 100 mm to 120 30 mm, more preferably between 105 mm to 115 mm, and most preferably between 107 mm to 110 mm.

This cap 35 is provided with a one-way valve 37, through which milk can flow only into the bottle. This valve 37 prevents milk from spilling from the bottle once it has been collected. In addition, the valve 37 automatically seals completely unless engaged to the breast shield 7. This ensures that when the pump 100 is dismantled immediately after pumping, no milk is lost from the collection bottle 3. It can be appreciated that this one-way valve 37 might also be placed on the breast shield 7 rather than in this bottle cap 35.

Alternatively, the milk bottle 3 may form a single integral part with a cap 35. Cap 35 may include an integral milk pouring spout.

In certain embodiments, a teat may be provided to attach to the annular protrusion 31A

or attach to the spout that is integral with cap 35, to allow the container 3 to be used directly as a bottle. This allows the milk container to be used directly as a drinking vessel for a child. The milk collection container may also be shaped with broad shoulders such that it can be adapted as a drinking bottle that a baby can easily hold.

Alternatively, or in addition, a spout may be provided to attach to the protrusion 31A for ease of pouring. A cap may also be provided to attach to the protrusion 31A in order to seal the milk collection bottle 3 for easy storage.

The pouring spout, drinking spout, teat or cap may also be integral to the milk collection container.

Further, the removable milk collection container or bottle includes a clear or transparent wall or section to show the amount of milk collected. Additionally, measurement markings (3A) may also be present on the surface of the container. This allows the level of milk within the container to be easily observed, even while pumping. The milk collection container or bottle may for example be made using an optically clear, dishwasher safe polycarbonate material such as Tritan™.

The milk collection container or bottle may include a memory or a removable tag, such as a tag including an NFC chip, that is programmed to store the date and time it was filled with milk, using data from the breast pump system or a connected device such as a smartphone. The container therefore includes wireless connectivity and connects to a companion app. The companion app then tracks the status of multiple milk collection containers or bottles to select an appropriate container or bottle for feeding. The tag of the bottle may also be programmed to store the expiry date of the milk as well as the quantity of the milk stored.

Figures 7 and 8 show front views of a breast pump system 100. The outer-surface of the housing 1 has been drawn translucent to show the components inside. The control circuitry 71 for the breast pump 100 is shown in these figures. The control circuitry in the present embodiment comprises four separate printed circuit boards, but it is appreciated that any other suitable arrangement may be used.

The control circuitry may include sensing apparatus for determining the level of milk in the container 3. The control circuitry may further comprise a wireless transmission device for communicating over a wireless protocol (such as Bluetooth) with an external device. This may be the user's phone, and information about the pumping may be sent to this device. In embodiments where the user interface comprises a breast toggle button 5E, information on which breast has been selected by the user may also be transmitted with the pumping information. This allows the external device to separately track and record pumping and milk expression data for the left and right breasts.

There should also be a power charging means within the control circuitry 71 for charging the battery 81. While an external socket, cable or contact point may be required for charging, a form of wireless charging may instead be used such as inductive or resonance charging. In the Figures, charging port 6 is shown for charging the battery 81. This port 6 may be located anywhere appropriate on the housing 1.

Figure 8 shows the location of the battery 81 and the pumps 83A, 83B mounted in series inside the housing 1. While the depicted embodiment shows two pumps 83A, 83B it is appreciated that the present invention may have a single pump. Preferably, an air filter 86 is provided at the output to the pumps 83A, 83B. In preferable embodiments, the pumps 83A, 83B are piezoelectric air pumps (or piezo pumps), which operate nearly silently and with minimal vibrations. A suitable piezo pump is manufactured by TTP Ventus, which can deliver in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free flow. The rear side of the second half of the diaphragm housing 19B in the housing 1 is provided with a pneumatic connection spout. The pumps 83A, 83B are pneumatically connected with this connection spout.

Operation of the breast pump 100 will now be described. Once the breast pump 100 is activated and a pumping cycle is begun, the pumps 83A, 83B generates a negative air pressure which is transmitted via an air channel to a first side of the diaphragm 13 mounted on the diaphragm housing 19A. This side of the diaphragm 13 is denoted the pumping side 13B of the diaphragm 13.

The diaphragm 13 transmits this negative air pressure to its opposite side (denoted the milk-flow side 13A). This negative pressure is transferred through a small opening in the

diaphragm housing 19A to the breast shield nipple tunnel 9 and the curved opening 7B of the breast shield 7 that contacts the breast. This acts to apply the pressure cycle to the breast of the user, in order to express milk. The milk is then drawn through the nipple tunnel 9, to the one way valve 37 that remains closed whilst negative pressure is applied. When the negative air pressure is released, the valve 37 opens and milk flows under gravity past the valve 37 and into milk container 3. Negative air pressure is periodically (e.g. cyclically, every few seconds) applied to deliver pre-set pressure profiles such as profiles that imitate the sucking of a child.

While the depicted embodiment of the breast pump 100 is provided with two pumps, the following schematics will be described with a single pump 83. It is understood that the single pump 83 could be replaced by two separate piezo air-pumps 83A, 83B as above.

Figure 9 depicts a schematic of a further embodiment of a breast shield nipple tunnel 9 for a breast pump 100. The breast shield nipple tunnel 9 is provided with an antechamber 91 and a separation chamber 93. A protrusion 95 extends from the walls of the breast shield nipple tunnel 9 to provide a tortuous air-liquid labyrinth path through the breast shield nipple tunnel 9. In the separation chamber 93 there are two opening 97, 99. An air opening 97 is provided in an upper surface 93A of the separation chamber 93. This upper surface 93 is provided transverse to the direction of the breast shield nipple tunnel 9. This opening 97 connects to the first side of the diaphragm housing 19A and is the source of the negative pressure. This airflow opening 97 also provides a route for air to flow as shown with arrow 96. It is appreciated that the tortuous pathway is not necessary and that a breast shield nipple tunnel 9 without such a pathway will work.

The other opening 99 is a milk opening 99. The milk opening 99 is provided on a lower surface 93B of the separation chamber 93 and connects in use to the container 3. After flowing through the tortuous breast shield nipple tunnel 9 pathway, the milk is encouraged to flow through this opening 99 into the container 3. This is further aided by the transverse nature of the upper surface 93A. In this manner, expressed milk is kept away from the diaphragm 13. As such, the breast pump 100 can be separated into a "air" side comprising the pump 83, the connection spout 85 and the pumping side 13B of the diaphragm 13 and a "milk-flow" side comprising the breast shield 7, the milk collection container 3 and the milk-flow side 13A of the diaphragm 13. This ensures that all of the

"milk-flow" components are easily detachable for cleaning, maintenance and replacement. Additionally, the milk is kept clean by ensuring it does not contact the mechanical components. While the present embodiment discusses the generation of negative pressure with the pump 83, it will be appreciated that positive pressure may instead be generated.

While the embodiments described herein use a diaphragm 13, any suitable structure to transmit air pressure while isolating either side of the system may be used.

The breast pump may further comprise a pressure sensor in pneumatic connection with the piezo pump. This allows the output of the pump to be determined.

Figure 10 shows a schematic of a basic pneumatic system 200 for a breast pump 100. In the system 200 milk expressed into the breast shield 7 is directed through the breast shield nipple tunnel 9 through the torturous air-liquid labyrinth interface 95. The milk is directed through the non-return valve 37 to the collection container 3. This side of the system forms the "milk-flow" side 201.

The rest of the pneumatic system 200 forms the air side 202 and is separated from contact with milk. This is achieved by way of a flexible diaphragm 13 which forms a seal between the two sides of the system. The diaphragm 13 has a milk-flow side 13A and an air side or pumping side 13B.

The air side 202 of the system 200 is a closed system. This air side 202 may contain a pressure sensor 101 in pneumatic connection with the diaphragm 13 and the pump 83. Preferably, the pump 83 is a piezoelectric pump (or piezo pump). Due to their low noise, strength and compact size, piezoelectric pumps are ideally suited to the embodiment of a small, wearable breast pump. The pump 83 has an output 83A for generating pressure, and an exhaust to the atmosphere 83B. In a first phase of the expression cycle, the pump 83 gradually applies negative pressure to half of the closed system 202 behind the diaphragm 13. This causes the diaphragm 13 to extend away from the breast, and thus the diaphragm 13 conveys a decrease in pressure into the breast shield 7. The reduced pressure encourages milk expression from the breast, which is directed through the tortuous labyrinth system 95 and the one-way valve 37 to the collection bottle 3.

While in the depicted embodiment the air exhaust 83B is not used, it may be used for functions including, but not limited to, cooling of electrical components, inflation of the bottle to determine milk volume (discussed further later) or inflation of a massage bladder or liner against the breast. This massage bladder may be used to help mechanically encourage milk expression. More than one massage bladder may be inflated regularly or sequentially to massage one or more parts of the breast. Alternatively, the air pump may be used to provide warm air to one or more chambers configured to apply warmth to one or more parts of the breast to encourage let-down.

The air side 202 further comprises a two-way solenoid valve 103 connected to a filtered air inlet 105 and the pump 83. Alternatively, the filter could be fitted on the pump line 83A. If the filter is fitted here, all intake air is filtered but the performance of the pump may drop. After the negative pressure has been applied to the user's breast, air is bled into the system 202 through the valve 103 in a second phase of the expression cycle. In this embodiment, the air filter 105 is affixed to this inlet to protect the delicate components from degradation. In particular, in embodiments with piezoelectric components, these are particularly sensitive.

The second phase of the expression cycle and associated switching of valve 103 is actioned once a predefined pressure threshold has been reached. The pressure is detected by a pressure sensor 101.

In certain embodiments, if the elasticity and extension of the diaphragm 13 may be approximated mathematically at different pressures, the pressure measured by sensor 101 can be used to infer the pressures exposed to the nipple on the opposite side of the diaphragm 13. Figure 11 shows an alternative pneumatic system 300. The core architecture of this system is the same as the system shown in Figure 10.

In this system 300, the closed loop 202 is restricted with an additional three way solenoid valve 111. This valve 111 allows the diaphragm 13 to be selectively isolated from the rest of the closed loop 202. This additional three way valve 111 is located between the diaphragm 13 and the pump 83. The pressure sensor 101 is on the pump 83 side of the three way valve 111. The three way valve 111 is a single pole double throw (SPDT) valve,

wherein: the pole 111A is in pneumatic connection with the pump 83 and pressure sensor; one of the throws 11 is in pneumatic connection with the diaphragm 13; and the other throw 111C is in pneumatic connection with a dead-end 113. This dead-end 113 may either be a simple closed pipe, or any component(s) that does not allow the flow of air into the system 202. This could include, for example, an arrangement of one-way valves.

In this system 300, therefore, the pump 83 has the option of applying negative pressure directly to the pressure sensor 101. This allows repeated testing of the pump in order to calibrate pump systems, or to diagnose issues with the pump in what is called a dead end stop test. This is achieved by throwing the valve to connect the pump 83 to the dead end 113. The pump 83 then pulls directly against the dead end 113 and the reduction of pressure within the system can be detected by the pressure sensor 101.

The pressure sensor detects when pressure is delivered and is then able to measure the output of the pumping mechanism. The results of the pressure sensor are then sent to an external database for analysis such as a cloud database, or are fed back to an on-board microcontroller that is located inside the housing of the breast pump system.

Based on the pressure sensor measurements, the breast pump system is able to dynamically tune the operation of the pumping mechanism (i.e. the duty or pump cycle, duration of a pumping session, the voltage applied to the pumping mechanism, the peak negative air pressure) in order to ensure a consistent pressure performance across different breast pump systems.

In addition, the breast pump system, using the pressure sensor measurements, is able to determine if the pump is working correctly, within tolerance levels. Material fatigue of the pump is therefore directly assessed by the breast pump system. Hence, if the output of the pumping mechanism degrades over time, the breast pump system can tune the pumping mechanism operation accordingly. As an example, the breast pump system may increase the duration of a pumping session or the voltage applied to the pumping mechanism to ensure the expected pressures are met.

This ensures that the user experience is not altered, despite the changing output of the pump as it degrades over time. This is particularly relevant for piezo pumps where the output of the pump may vary significantly.

The microcontroller can also be programmed to deliver pre-set pressure profiles. The pressure profiles may correspond to, but not necessarily, any suction patterns that would mimic the sucking pattern of an infant. The patterns could mimic for example the sucking pattern of a breastfed infant during a post birth period or at a later period in lactation.

The profiles can also be manually adjusted by the user using a control interface on the housing of the breast pump system or on an application running on a connected device.

Additionally, the user is able to manually indicate the level of comfort that they are experiencing when they are using the system. This can be done using a touch or voice-based interface on the housing of the breast pump system itself or on an application running on a connected device.

The system stores the user-indicated comfort levels together with associated parameters of the pumping system. The pressure profiles may then be fine scaled in order to provide the optimum comfort level for a particular user.

The profiles or any of the pumping parameters may be calculated in order to correlate with maximum milk expression rate or quantity.

The pressure profiles or any of the pumping parameters may also be dynamically adjusted depending on the real time milk expression rate or quantity of milk collected. The pressure profiles or any of the pumping parameters may also be dynamically adjusted when the start of milk let-down has been detected.

Additionally, the system is also able to learn which parameters improve the breast pump system efficiency. The system is able to calculate or identify the parameters of the pumping mechanism that correlate with the quickest start of milk let-down or the highest volume of milk collected for a certain time period. The optimum comfort level for a particular user may also be taken into account.

Figure 12 shows a schematic for a system 400 for a breast pump 100 which can estimate the volume of milk collected in the collection container 3 from data collected on the air-side part 202 of the system 400.

The pump 83 is connected to the circuit via two bleed valves 126, 128. The first bleed valve 126 is arranged to function when the pump 83 applies a negative pressure. As such, this valve 126 is connected to a "bleed in" 127, for supplying atmospheric air to the system 202.

The second bleed valve 128 is arranged to function when the pump 83 applies a positive pressure. As such, this valve 128 is connected to a "bleed out" 129 for bleeding air in the system 202 to the atmosphere.

Although Section C describes the preferred embodiment for measuring or inferring the volume of milk collected in the milk collection container using IR sensors, an alternative method for measuring or inferring the volume of milk collected in the milk collection container using pressure sensors is described also below.

During a milking pump cycle, the pump 83 applies negative pressure on the air side 13B of the diaphragm 13 which causes its extension towards the pump 83. This increases the volume of the space on the milk side 13B of the diaphragm 13. This conveys the decrease in pressure to the breast to encourage expression of milk. A set of three non-return valves 121, 123, 125 ensure that this decrease in pressure is applied only to the breast (via the breast shield 7) and not the milk collection container 3. To measure the volume of milk collected in the container 3, the pump 83 is used instead to apply positive pressure to the diaphragm 13. The diaphragm 13 is forced to extend away from the pump 83 and conveys the pressure increase to the milk side 201 of the system 400. The three non-return valves 121, 123, 125 ensure that this increase in pressure is exclusively conveyed to the milk collection container 13.

The breast pump may further comprise: a first non-return valve between the milk flow side of the diaphragm and the breast shield, configured to allow only a negative pressure to be applied to the breast shield by the pump; a second non-return valve between the milk-flow side of the diaphragm and the milk collection container configured to allow only a positive pressure to be applied to the milk collection container by the pump; and a pressure sensor in pneumatic connection with the pressure-generation side of the diaphragm.

The resulting pressure increase is monitored behind the diaphragm 13 from the air-side 202 by a pressure sensor 101. Preferably, the pressure sensor 101 is a piezoelectric pressure sensor (piezo pressure sensor). The rate at which the pump 83 (at constant strength) is able to increase the pressure in the system 400 is a function of the volume of air that remains in the milk collection container 3. As air is many times more compressible than liquid, the rate at which pressure increases in the system 400 can be expressed as an approximate function of the volume of milk held in the collection container 3.

Thus by increasing the pressure in this fashion, the rate of pressure increase can be determined, from which the volume of milk held in the container 3 is calculable. Figure 13 shows repeated milking and volume measurement cycles as the collection container 3 is filled. To determine the rate of pressure increase the pump 83 was run for a fixed time. As pumping proceeds and the volume of air reduces in the system 400, the pump 83 is able to achieve a higher pressure. Each milking cycle is represented by a positive pressure spike 41. There is a clear upwards trend 43 in magnitude of positive pressures achieved as the collection container 3 is filled.

A method of estimating the pressure applied by a breast pump may comprise the steps of: selecting a pressure cycle from a pre-defined list of pressure cycles; applying pressure with the pump to stimulate milk expression; reading the output of the pressure sensor; and adjusting the applied pressure of the pump to match the pressure profile selected. This allows for repeatable application of force to the breast, even as the pump performance degrades.

Preferably the method further comprises the steps of: approximating the elasticity and extension of the diaphragm at the relevant pressure; and calculating an estimated applied pressure based upon the output of the pressure sensor and the approximated elasticity and extension of the diaphragm.

Alternatively, a method of estimating the milk collected by a breast pump may comprise the steps of: generating a positive pressure with the pump; transmitting the positive pressure via the diaphragm and second non-return valve to only the milk collection

container; measuring the increase in pressure by the pressure sensor in pneumatic connection with the diaphragm; estimating the volume of milk inside the milk collection container based upon the rate of increase of pressure. In this manner, the volume of milk can be estimated remotely.

In this manner, an estimate can be obtained for the volume of milk in the container 3 based upon the measured pressures.

Figure 13 also shows a dead end stop pump test 45 as described above. The negative spike shows the application of negative pressure directly to the pressure sensor 101.

2. Breast shield sizing and nipple alignment

The correct sizing of the breast shield and the alignment of the nipple in the breast shield are key for an efficient and comfortable use of the breast pump. However breast shape, size as well as nipple size and position on the breast vary from one person to another and one breast from another. In addition, women's bodies often change during the pumping life cycle and consequently breast shield sizing may also need to be changed. Therefore, a number of breast shield sizes are available. Guide lines for correct nipple alignment are also provided.

With reference to Figure 14, three breast shield sizes are shown (A1, B1, C1). The substantially clear breast shield gives an unobstructed view of the breast and allows a user to easily confirm that she has the appropriate sized shield for her breast.

In order to determine the correct breast shield size and nipple alignment, the breast shield and the diaphragm are detached from the housing and placed on the breast with the sizing symbol facing upwards (with the diaphragm positioned below the nipple) and the nipple aligned in the centre of the fit lines (as shown in A2, B2, C2). The transparent breast shield allows the user to observe the nipple while adjusting the position of the breast shield in order to align the nipple correctly near the centre of the breast shield nipple tunnel. Prior to using the pump, the nipple is aligned correctly, and the breast shield is pushed into place ensuring the seal is correctly positioned on the breast shield. The fit lines should be directly aligned with the outside of the nipple. The correct

alignment is illustrated B2.

When the nipple is correctly aligned, the user then rotates the breast shield in order for the diaphragm to be positioned on top of the nipple. The user may then quickly assemble the rest of the breast pump (i.e. the housing and the milk container) on the breast shield via a one-click attachment mechanism confirming correct engagement, which may be performed one-handed. Nipple alignment may therefore be easily maintained. Audio and/or haptic feedback may also be provided to further confirm correct engagement.

3. Connected Device Application

Figures 15 to 20 show examples of screenshots of a connected device application that may be used in conjunction with the breast pump system as described above. The interface shown here is an example only and the same data may be presented via any conceivable means including animated graphics, device notifications, audio or text descriptions.

Figure 15 shows a homepage of the application with different functions provided to the user which can be accessed either directly while pumping or at a later time in order for example: to review pump settings or the history of previous pumping sessions.

Figure 16 shows a status page with details of remaining battery life, pumping time elapsed and volume of milk inside the milk container.

Figure 17 shows screenshots of a control page, in which a user is able to control different pump parameters for a single breast pump (A) or two breast pumps (B). The user may press on the play button to either start, pause, or resume a pumping activity. The user may also directly increase or decrease the rate of expression using the (+) or (-) buttons. When only one breast is being pumped (A), the user may also indicate if it is either the right or left breast that is being pumped. The user may also control the pump peak pressure or alternatively may switch between different pre-programmed pressure profiles such as one mimicking the sucking pattern of a baby during expression or stimulation cycle.

Figure 18 shows a page providing a summary of the last recorded pumping session.

Figure 19 shows a page providing a history of previous pumping sessions. The user may scroll down through the page and visualize the data related to specific pumping sessions as a function of time.

The application is also capable of providing notifications relating to pumping. Figure 20 shows a screenshot of the application, in which a user is provided a notification when the milk collection bottle is full. Other generated notifications may include warnings about battery life, Bluetooth connection status or any other wireless communication status, status of miss-assembly, excessive movement or lack of expression.

Figure 21 shows a further example with a screenshot of an application running on a connected device. The page shows the pumping status when a user is using a double pump mode of operation with a pump on each breast. The user is able to manually control each pump individually and may start, stop or change a pumping cycle, increase or decrease each pump peak pressure, or switch between different pre-program pressure profiles such as one mimicking the sucking pattern of a baby during an expression or stimulation cycle. The application also notifies the user when a milk collection container is nearly full as shown in Figure 22.

Figure 23 shows a status page with an alert notifying the user that the milk collection container of the pump on the right breast is full. A message is displayed that the pump session has paused and that the milk collection container should be changed or emptied before resuming pumping.

With reference to Figure 24, when the left and right pump are stopped or paused, the application displays the elapsed time since the start of each session (right and left), the total volume of milk collected in each bottle.

With reference to Figure 25, a page summarising the last session (with a double pump mode) is displayed.

In addition to the data provided to the user, and their interactions with the application, the app will also hold data that the user does not interact with. For example, this may include data associated with pump diagnostics. In addition to all functions and sources of

data discussed above, the application may itself generate metadata associated with its use or inputs, notes or files uploaded by the user. All data handled within the mobile application can be periodically transferred to a cloud database for analysis. An alternative embodiment of the breast pump system may include direct contact between the database and the pump, so that pumping data may be conveyed directly, without the use of a smartphone application.

In addition to providing data to the cloud, the application may also provide a platform to receive data including for example firmware updates.

4. Breast pump data analysis

The discreet, wearable and fully integrated breast pump may offer live expression monitoring and intelligent feedback to the user in order to provide recommendations for improving pump efficiency or performance, user comfort or other pumping/sensing variables, and to enable the user to understand what variables correlate to good milk flow.

Examples of variables automatically collected by the device are: time of day, pump speed, pressure level setting, measured pressure, pressure cycle or duty cycle, voltage supplied to pumps, flow rate, volume of milk, tilt,, temperature, events such as when let-down happens, when a session is finished. The user can also input the following variables: what side they have pump with (left or right or both), and the comfort level.

This is in part possible because the live milk volume measurement system functions reliably (as discussed in Section B). The breast pump system includes a measurement sub system including IR sensors that measures or infers milk flow into the milk container, and that enables a data analysis system to determine patterns of usage in order to optimally control pumping parameters. The generated data may then be distributed to a connected device and/or to a cloud server for analysis in order to provide several useful functions.

Figure 26 illustrates an outline of a smart breast pump system network which includes the breast pump system (100) in communication with a peripheral mobile device and application (270) and several cloud-based databases (268, 273). The breast pump system

(100) includes several sensors (262). Sensor data refers to a broad definition including data generated from any sensor or any other analogue/digital reading directly from the motherboard or any other component. However, within the embodiment detailed, these measurements include one or more of the following, but not limited to: milk volume measurements, temperature sensor readings, skin temperature sensing, pressure sensor readings, accelerometer data and user inputs through any physical device interface.

The device also contains a number of actuators, including, but not restricted to: piezoelectric pump(s), solenoid valve(s), IREDs and an LED display. Sensors and actuators within the device are coordinated by the CPU (263). In addition, any interactions, and data from these components, may be stored in memory (264).

Further to these components, the device also contains a communication chip, such as a Bluetooth chip (265) which can be used to communicate wirelessly with connected devices such as a peripheral mobile device (270). Through this connection any sensor data (267) generated in the breast pump can be sent to the connected device. This user data, along with any other metadata generated from a connected device app, can be provided to an online database which aggregates all user data (273). In addition, the communication chip will also allow the sending of user control data / firmware updates from the connected device to the breast pump system (266).

Raw data (271) collected from the measurement sub-system including sensors (262) may be analysed on a cloud database and the analysed data may be stored on the cloud (272). Through inferences provided by the analysed data, firmware updates (269) may be developed. These can be provided for download to the pump through, for example, an online firmware repository or bundled with the companion app in the connected device app store (268).

In addition, it should be appreciated that despite the sophistication of the proposed breast pump network, the breast pump still retains complete functionality without wireless integration into this network. Relevant data may be stored in the device's memory (264) which may then be later uploaded to the peripheral portion of the system when a connection is established, the connection could be via USB cable or wireless.

The measurement sub-system may analyse one or more of the following:

- the quantity of the liquid in the container above its base;
- the height of the liquid in the container above its base;
- the angle the top surface of the liquid in the container makes with respect to a baseline, such as the horizontal.

Based on whether the quantity and/or the height of the liquid in the container above its base is increasing above a threshold rate of increase, a haptic and/or visual indicator indicates if the pump is operating correctly to pump milk. For example, the visual indicator is a row of LEDs that changes appearance as the quantity of liquid increases.

The visual indicator may provide:

- an estimation of the flow rate;
- an estimation of the fill rate;
- an indication of how much of the container has been filled.

As a further example, an accelerometer may infer the amount of movement or tilt angle during a pumping session. If the tilt angle excesses a threshold, the system warns or alerts the user of an imminent spillage, or provides the user with an alert to change position. Alternatively, the system may also stop pumping to prevent spillage, and once the tilt angle reduces below the threshold, pumping may resume automatically. By sensing the movement or title angle during a pumping session, the system may also derive the user's activity such as walking, standing or lying.

Many variables can affect milk expression and data analysis of these multiple variables can help mothers to achieve efficient pumping regimes and improve the overall user experience.

Therefore, the measurement sub-system measures or infers milk flow into the milk container and enables a user to understand what variables (e.g. time of day, pump setting) correlates to good milk flow. The amount of milk expressed over one or more sessions is recorded as well as additional metrics such as: time of day, pump setting, length of a single pumping session, vacuum level, cycle times, comfort, liquids consumed by the mother. Live data or feedback is then provided to the user to ensure the breast pump is

being used properly and to support the user in understanding the variables that would correspond to the specific individual optimum use of the breast pump.

Furthermore, live data can be used to automatically and intelligently affect specific pumping parameters in order to produce the most efficient pumping session. For example, if the rate of expression increases, the milking cycle might be adjusted accordingly to achieve a more efficient, or more comfortable pumping cycle.

The measurement sub-system also enables a data analysis system to determine patterns of usage in order to optimally control pumping parameters. Collected metrics are transferred through wireless connections between the pump, a connected device or app and a cloud database. Additionally, the application can also connect to other apps residing on the connected device, such as fitness app or social media app or any other apps. Further metrics may also include the behaviour or specific usage of the user associated with the connected device while using the pump (detection of vision and/or audio cues, internet usage, application usage, calls, text message).

Different aspects of pumping can be automatically changed based on dynamic sensor feedback within the breast pump device. The data analysis system is able to access real-time data of pumping sessions and may be used to perform one or more of the following functions, but not limited to:

- indicate whether the milk is flowing or not flowing,
- measure or infer the quantity and/or height of the liquid in the container above its base,
- give recommendations to the mother for optimal metrics for optimal milk flow,
- give recommendations to the mother for optimal metrics for weaning,
- give recommendations to the mother for optimal metrics for increasing milk supply (e.g. power pumping),
- give recommendations to the mother for optimal metrics if an optimal session start time or a complete session has been missed,
- automatically set metrics for the pumping mechanism, such as length of a single pumping session, vacuum level, cycle times.
- automatically stop pumping when the milk container is full,
- automatically adjust one or more pumping parameters to achieve an optimum

pumping session,

- automatically adjust one or more pumping parameters to achieve a comfortable pumping session,
- automatically change the pumping cycle from a programmed cycle to another different programmed cycle, such as from a stimulation cycle to an expression cycle.

In addition, sensor feedback might be used to improve the physical function of the breast pump system itself. For example, an array of piezoelectric pumps may be dynamically adjusted in response to their operating temperatures so as to optimise the total life of the component whist maintaining peak pressures.

Many additional embodiments may be described for these simple feedback systems, yet the premise remains: real-time sensor feedback is used to automatically and dynamically adjust actuator function. Each feedback program may feasibly include any number and combination of data sources and affect any arrangement of actuators.

The data generated can also be used to generate large datasets of pumping parameters, user metadata and associated expression rates, therefore allowing the analysis of trends and the construction of associations or correlations that can be used to improve pumping efficiency, efficacy or any function related to effective milk expression. The analysis of large user datasets may yield useful general associations between pumping parameters and expression data, which may be used to construct additional feedback systems to include on firmware updates.

Multiple data sources can be interpreted simultaneously and several different changes to pumping might be actuated to increase pumping efficiency, user experience or optimize pump performance.

Collected metrics may be anonymised and exported for sharing to other apps, community or social media platforms on the connected device, or to an external products and services, such as community or social media platform. By contrasting the performance of different users in the context of associated metadata, users may be grouped into discrete 'Pumper profiles' or communities, which may then be used to

recommend, or action the most appropriate selection of intelligent feedback systems to encourage efficient expression. For example, a higher peak pressure may be recommended for women who tend to move more whilst pumping, so as to achieve more efficient expression.

SECTION B: IR SYSTEM

This section describes the milk detecting system used in the Elvie™ pump.

With reference to Figures 27 and 28, there is shown a device 270 for use in detecting the level of liquid inside a container 275. The device 270 is formed of a housing 271 in which is located a sensing assembly 272 comprising a series of optical emitters 273 (an array of three optical emitters is used on one implementation) which are relative to, and each located at a distance from, an optical receiver 274. In operation of the device as will be described, each optical emitter 273 is operable to emit radiation which is received by the optical receiver 274. In an embodiment of the invention, the series of optical emitters are each located equidistant from the optical receiver 274.

The optical emitters 273 and the optical receiver 274 from the sensing assembly 272 are located in a portion 276 of the device 270 which faces the container 275 when the device is connected to the container 275. The portion 276 of the device 270 containing the optical emitters 273 and the optical receiver 274 comprises a window 277 of material which is transparent to optical radiation. In this way, each of the optical emitters 273 and the optical receiver 274 have a line of sight through the window 277 into the container 275 when the device 270 is connected thereto.

A controller 278 comprising a CPU 279 and a memory 280 is provided in the device 270 for controlling the operation of the sensing assembly 272. An accelerometer 281 is also provided in the housing 271, which is operatively connected to the controller 278. Operation of the device 270 when connected to the container 275 will now be described.

In a principal mode of operation, to determine the level L of liquid inside the container 275, the controller 278 instructs the optical emitters 273 to each emit radiation towards the surface of the liquid inside the container 275 at a given intensity. The optical receiver 274 receives the reflected radiation from each optical emitter 273 via the surface of the liquid and each of these intensities is recorded by the controller.

For each operation of the sensing assembly 272, the controller 278 records the intensities of radiation emitted by each of the optical emitters 273 as intensities IE1; IE2…IEn

(where n is the total number of optical emitters), and records the intensities of radiation received by the optical receiver 274 from each of the optical emitters 273 as received intensities IR1; IR2…IRn.

By comparing the emitted radiation intensities IE1; IE2…IEn with the received radiation intensities IR1; IR2…IRn, the controller 278 calculates a series of intensity ratios IE1:IR1; IE2:IR2…IEn:IRn, which are then used to determine the level of the liquid inside the container. At the most basic level, if the intensity ratio of IE1:IR1 is the same as IE2:IR2, given the optical emitters 273 are equidistant from the optical receiver 274, this indicates that the level of the liquid inside the container is parallel to the top of the bottle, as shown in Figure 27. In contrast, if these two intensity ratios are different, this indicates that the liquid level is at a different angle, such as that shown in Figure 28.

To accurately determine the level and the quantity of liquid inside the container 275, the controller 278 processes the recorded intensity ratios using a database located in the memory 280. The database contains an individual record for each container which is operable to connect with the device 270. Each record from the database contains a look-up table of information, which contains expected intensity ratios (IE1:IR1 and IE2:IR2) for the container 275 when filled at different orientations, and with different quantities of liquid.

By comparing the information from the look-up table with the recorded intensity ratios, the controller 278 calculates the level and quantity of liquid inside the container 275 and stores this information in the memory 280.

In situations where a container 275 to the device 270 contains no stored record in the database, the sensing assembly 272 can be used in a calibration mode to create a new record. In the calibration mode, the sensing assembly 272 is operated as the container is filled from empty, and as it is positioned at different orientations. At each point during the calibration mode, the controller 278 calculates the recorded intensity ratios (IE1:IR1 and IE2:IR2) and stores them in the record relating to the container 275. For each set of recorded intensity ratios, the user includes information in the record relating to the orientation and fill level of liquid inside of the container 275.

To improve the accuracy of the results obtained by the device 270 during its use, the controller 278 when recording each intensity ratio also records a parameter from the accelerometer 281 relating to the acceleration experienced by the device 270. For each recorded acceleration parameter, the controller 278 determines whether the parameter 278 exceeds a predetermined threshold acceleration parameter stored in the memory 280. The predetermined threshold is indicative of an excessive acceleration, which causes sloshing of liquid inside the container 275 connected to the device 270. In the event of a recorded acceleration parameter exceeding the predetermined threshold acceleration parameter, the controller 278 flags the recorded intensity ratios associated with the recorded acceleration parameter as being unreliable (due to sloshing).

Even without the use of the accelerometer 281, the controller 278 is nonetheless operable to determine whether a set of recorded intensity ratios occur during a period of excess acceleration. In this regard, for each set of intensity ratios recorded at a given time, the controller 278 checks whether any of these intensity ratios is of a predetermined order of magnitude different than the remaining recorded intensity ratios from the set. In the event that the controller 278 determines that this is the case, this indicates that the liquid inside the container has 'sloshed' as a result of the excess acceleration, as shown in Figure 29. In this event, the controller 278 flags the set of recorded intensity ratios as being unreliable.

It will be appreciated that instead of recording the relative intensities of radiation emitted by the optical emitters 273 with the radiation received by the optical emitter 274, the controller 278 could instead record the time taken for radiation emitted by each of the optical emitters 273 to be received by the optical receiver 274. In this arrangement, the look up table would instead contain time periods as opposed to intensity ratios.

In terms of the applications for the device 270, it will be appreciated that the device can be used in a wide variety of applications. One possible application is the use of the device 270 to determine the level of liquid located within a container 275, such as a baby bottle, used as part of a breast pump assembly. In this arrangement, the device 270 is associated with a breast pump 301 which assists with the expression of milk from a breast. The breast pump may be located in the housing 271 of the device 270 as shown in Figure 30, or it may be realisably connected to the housing 271.

Either way, the device 270 would be connectable to the container 275 such that milk expressed by the breast pump can pass from the pump via a channel 302 into the container 275.

The breast pump may be any type of breast pump system including any shapes of milk container or bottle and may comprise a pump module for pumping milk from a breast. The pump module being contained within the housing may comprise: a coupling, a container attachable to the housing via the coupling to receive milk from the pump, a sensing assembly within the housing and comprising at least one optical emitter operable to emit optical radiation towards the surface of the body of milk held in the container when the housing is connected to the container, an optical receiver for receiving the reflected radiation from the surface of the milk, and a controller electrically connected to the sensing assembly for receiving signals from the optical receiver and calculating the level of the milk inside the container based on the reflected radiation received by the optical receiver.

By determining the level of milk inside the container based on reflected radiation from the surface of the milk in the container, there is no need to monitor the individual droplets of milk entering the container, such that the sensing assembly can avoid errors associated with measuring these droplets. For example, because we take multiple reflection-based measurements once the container is filled, we can generate an average measurement that that is more accurate than a single measurement. But with systems that rely in counting individual droplets, that is not possible – further, systemic errors (e.g. not counting droplets below a certain size) will accumulate over time and render the overall results unreliable. Furthermore, by not needing to measure these droplets, the sensing assembly from the breast pump need not always be on during the pumping process, which saves power.

When at least two optical emitters are used, the sensing assembly from the breast pump may determine the level of milk inside the container more accurately and irrespective of the orientation of the liquid level inside the container.

Each optical emitter may be equidistant from the optical receiver in order for the

controller to easily calculate the level of the milk inside the container based on the reflected radiation originating from each optical emitter. The signals from the optical receiver preferably comprise information relating to the intensity of the radiation received by the optical receiver.

Each optical emitter may be operable to emit radiation at a different wavelength, or at a different time, than the other optical emitters. In this way, the controller can more easily process the signals from the optical receiver, and more easily distinguish between the radiation emitted by each of the optical emitters.

The optical emitter may emit radiation in the visible range of wavelengths. Alternatively, it may be UV or IR light. The emitted wavelength may be for example between 10nm and 1mm.

The sensing assembly may also comprise at least one accelerometer electrically connected to the controller. The controller may be configured to record an accelerometer parameter from the accelerometer and determine whether the accelerometer parameter exceeds a predetermined threshold. The predetermined threshold may be indicative of an excessive acceleration, which might cause sloshing of milk inside any container connected to the breast pump.

Another application for the device 270 is as a collar for detecting the level/quantity of liquid in a container 275, such as a baby bottle, via its lid 310. An example of the device 270 being used as such a collar is shown in Figure 31. In this arrangement, the device 270 is located between the container 275 and the lid 310, and comprises a first end 311 having a first coupling 312 for attaching the collar to the lid 310. The device comprises a second end 313 having a second coupling 314 for attaching the device 270 to the container 275. The second coupling may be a screw thread, shown in Figure 31, on the inside surface of the container 275. In this way, the distinctive bottom inside surface can be used by the sensing assembly 272 to more easily calibrate itself to the container 275 on which the distinctive bottom inside surface is located. The distinctive bottom may also be used to help identify which container 275 the device is connected to, and thus which record should be used from the database when the device 270 is used.

To further improve the accuracy of the sensing assembly 272, the controller 278 may also be configured to use the recorded information from the accelerometer 281, in situations where the record acceleration is below the predetermined threshold acceleration parameter, to calculate a more accurate liquid level and/or quantity of liquid located inside the container which is compensated for acceleration.

In one particular arrangement, the controller 278 may poll the accelerometer 281 prior to each operation of the sensing assembly 272 to verify that the device 270 is not currently undergoing excessive acceleration. In the event of the controller 278 determining excessive acceleration in the device 270, the controller 278 would continually re-poll the accelerometer, and not operate the sensing assembly 272, until the parameter from the accelerometer is determined as being below the predetermined threshold acceleration parameter stored in the memory 280.

It will also be appreciated that for each container record stored in the database, the container record may comprise a plurality of look up tables, wherein each look up table is associated with a particular liquid used in the container, and wherein each look up table contains its own set of intensity ratios. In this way, the device 270 can more accurately determine the level/quantity of different liquids used in a particular container 275.

As described herein, the sensing assembly 272 has been described as having a plurality of optical emitters 273. It will be appreciated however that the sensing assembly could operate using a single optical emitter 273 and plurality of optical receivers 274. In this arrangement, each record from the database would contain a plurality of ratios relating to the emitted radiation from the optical emitter 273 as received by each of the optical receivers 274. In use of the device 270, the controller 278 would then similarly record the emitted radiation from the optical emitter 273 as received by each of the optical receivers 274. In an alternate arrangement, there may be provided a plurality of optical emitters 273 and a plurality of optical receivers 274, wherein each optical emitter 273 is associated with a respective optical receiver 274. In its simplest arrangement, the sensing assembly 272 may comprise a single optical emitter 273 and a single optical receiver 274.

In certain configurations, the optical emitters 273 may together emit radiation having the same wavelength. In other configurations, the optical emitters 273 may each emit

radiation having a different wavelength. In this latter configuration, the optical receiver 274 would then be able to determine which optical emitter 273 is associated with any given received radiation, based on the wavelength of the received radiation.

The optical emitters 273 may also each emit radiation at different times, such to allow the controller 278 to more easily process the signals from the optical receiver 274, and more easily distinguish between the radiation emitted by each of the optical emitters 273.

In relation to the electrical connection between the controller 278 and the sensing assembly 272, it will be appreciated this electrical connection may be either a wired/wireless connection as required.

Although not shown in the Figures, the device 270 herein described is preferably powered by a battery or some other power source located in the device 270. In other embodiments, the device 270 may be powered using mains electricity.

In one configuration, it is also envisaged that rather than the controller 278 comparing the information from the look-up table with the recorded intensity ratios to calculate the level and quantity of liquid inside the container 275, the controller 278 could instead process the recorded intensity ratios through a liquid-level equation stored in the memory 280. In this configuration, the liquid-level equation could be a generalised equation covering a family of different containers, or could be an equation specific to a container having a given shape and/or type of liquid inside.

It will also be appreciated that in some applications of the device 270, the device could be used to detect the level of a solid, as opposed to a liquid, in a container. As used herein, the terms 'optical emitter' and 'optical receiver' are intended to cover sensors which can emit radiation in or close to the optical wavelength. Any type of radiation at or close to the optical wavelength is suitable provided that it does not have any harmful effects. The exact wavelength is not important in the context of the invention. Such sensors thus include those which can emit visible radiation (such as radiation having wavelengths in the region of 400nm-700nm), and/or those which can emit IR radiation (such as radiation having wavelengths in the region of 700nm-1mm and/or those which can emit UV radiation (such as radiation having wavelengths in the region of 10nm to

400nm).

Existing prior art for such a sensor module is the apparatus disclosed in RU2441367. In this apparatus, the container is an industrially sized milk tank, which only includes a single laser mounted at the top of the tank. Whilst this apparatus is suited for large-sized containers, which do not move in use, the apparatus is less-suited for applications where the container moves in use, or where the liquid level inside the container is non perpendicular to the laser beam shone into the container. In contrast, the sensor module described above can be used in a variety of different applications, is conveniently located within a housing, and which by virtue of it having at least two optical emitters, can determine the level of liquid even inside containers of irregular shapes, and which can determine the level of liquid inside a container irrespective of the orientation of the liquid level inside the container.

Further to the embodiments of the fluid measurement system in different contexts, it can be appreciated that different functions entirely may be possible using the same component structure. For example, it is known that certain molecules within breast milk absorb specific wavelengths of light at characteristic propensities. Whilst the proposed system uses multiplexed IREDs at the same wavelengths to perform proximity measurements, the same array of IREDs may instead be used to emit several different wavelengths of light and determine their absorption upon reflection. If appropriately calibrated, the system may be able to report on the presence or concentration of specific compounds in the expressed milk, such as fat, lactose or protein content.

In addition to this embodiment, it is feasible that the system might be applied to monitor the change in volume of any other container of liquid, given there is sufficient reflection of IR off its surface. These embodiments might include for example: liquid vessel measurement such as for protein shakes, cement or paint, or volume measurements within a sealed beer keg.

SECTION C: BRA CLIP

This section describes a bra clip that forms an accessory to the Elvie™ pump.

It relates to a system allowing a user to quickly and simply adjust the cup size of a maternity bra to allow discrete and comfortable insertion and use of an integrated wearable breast pump. As such, the user does not need a specialised adjustable bra; instead the present system works with all conventional maternity bras. The user also does not have to purchase any larger bras to wear while pumping.

As shown in Figure 32, a typical maternity bra 320 comprises a support structure made up of shoulder straps 321 which support the bra 320 on the wearer's shoulders, and a bra band 322 for extending around a user's ribcage, comprising two wings 323 and a central panel or bridge 324. The straps 321 are typically provided with adjustment mechanisms 325 for varying the length of the straps 321 to fit the bra 320 to the wearer. At the outermost end of each wing, an attachment region 326 is provided. Typically, hooks 327 and loops 328 are provided for securing the bra 320 at the user's back. However, any other suitable attachment mechanism may be used. Alternatively, the attachment region 326 may be provided at the front of the bra 320 in the bridge region 324, with a continuous wing 323 extending continuously around the wearer's back. Typically, a number of sets of loops 328 are provided to allow for variation in the tightness of the bra 320 on the wearer. While shown as having a separation in Figure 32, the wings 323 and bridge 324 may form a single continuous piece in certain designs. Likewise, while shown with a distinct separation in Figure 32, the shoulder straps 321 and the wings 323 may likewise form a single continuous piece.

The maternity bra 320 is further provided with two breast-supporting cups 329 attached to the support structure. The cups 329 define a cup size, which defines the difference in protrusion of the cups 329 from the band 322. The European standard EN 13402 for Cup Sizing defines cup sizes based upon the bust girth and the underbust girth of the wearer and ranges from AA to Z, with each letter increment denoting a 2 cm difference between the protrusion of the cups 329 from the band 322. Some manufacturers do vary from these conventions in denomination, and some maternity bras are measured in sizes

of S, M, L, XL, etc.

The cups 329 may be stitched to the bra band 321. At least one of the cups 329, is in detachable attachment with the corresponding strap 321. In particular, this is achieved at attachment point 330 where a hook 331 attached to the bra strap 321 engages with a clasp 331 attached to the cup 329. The hook 331 and the bra strap adjuster 325 are set such that in the closed position, the cup size of the bra 320 fits the wearer's breasts.

In Figure 32, the left cup 329 is shown attached to its attachment point 330, which the right cup 329 is unattached. In this manner, the wearer is able to detach the cup 329 to expose their breast for feeding or for breast pumping. Once this is completed, the cup 329 is reattached and the maternity bra 320 continues to function as a normal bra.

While in the depicted embodiments, a hook 331 is shown on the bra strap 321 and a clasp 332 is shown on the cup 329, it is appreciated that the provision of these may be reversed, or that alternative attachment mechanisms may be used.

A maternity bra therefore may comprise a support structure comprising shoulder straps and a bra band and a first and a second cup each attached to the support structure to provide a first cup size, at least one cup being at least partially detachable from the support structure at an attachment point.

In other embodiments, the detachable attachment point 330 may be provided at a different location, such as at the attachment between the bra band 322 and the cup 329. The mechanism for such an attachment point is the same as described above.

A clip has been designed such that it is configured to be attached to the support structure at a position away from the attachment point. This results in the original attachment point being usable, with the clip providing an alternative attachment point to give, in effect, an adjusted cup size.

Alternatively, the clip may also be attachable to the support structure at a plurality of non-discrete positions. This ensures essentially infinite adjustment of the clip position such that the perfect position for the user can be found.

The clip can also extend between an unextended and an extended state, and can attach to the support structure at the attachment point; the first cup size is providable when the at least partially detachable cup is attached to the clip when the clip is an unextended state; the second cup size is providable when the at least partially detachable cup is attached to the clip when the clip is in an extended state. An extendable clip like this allows quick switching between the two states in use.

Figure 33 depict a clip 335 according to the present invention, along with a clasp 332 shown in isolation from the bra cup 329 it is normally attached to. The clip comprises a first engagement mechanism and at least one second engagement mechanism(s). The clip is attachable in a releasable manner to the support structure at a first position via the first engagement mechanism and attachable in a releasable manner to one of the partially detachable cups via the second engagement mechanism to provide a second cup size different to the first cup size. The clip 335 is provided with a material pathway 336 which receives a portion of the bra strap 321. In the particular embodiment of these Figures, the clip 335 is substantially U-shaped, with a narrowing profile towards its open end. However, it is appreciated that any other suitable shape with a material pathway may be used, such as an S-shape or E-shape. The clip 335 is designed to be attached to the bra strap 321 in a releasable manner, with the slot 336 acting as a support engaging mechanism. The releasable manner means that the clip 335 may be simply removed from the bra 320 without causing any damage to the functioning of the bra 320. To enhance the ease of attachment, the clip 335 may be provided with outwardly extending wings 204 which help direct the bra strap 321 into the clip 335. The clip 335 is further provided with a hook 220 acting as a cup engaging mechanism which can engage with the clasp 332.

Figure 33 (c) shows the clip 335 being attached to a bra strap 321 in order to provide a second attachment point 337 for the clasp 332 to attach to, and hence to provide a second cup size for the bra 320. In this particular embodiment, the clip 335 is attached in a portion of strap 321A below the original attachment point 330 and hence the second attachment point 337 is likewise below the original attachment point. This results in a second cup size larger than the first cup size. In preferred embodiments, as shown in these Figures, the clip 335 engages with the support structure in a direction transverse to

the direction in which it engages with the cup.

Figure 33 (d) and (e) show how a wearer is able to move between the first and second cup sizes. In 33(d), the cup 329 is attached at the first attachment point 330 to provide a first cup size. The wearer then disengages the clasp 332 from the hook 331 at the hook 338 at the second engagement point 239. In this manner, the wearer is easily able to transition between the two cup sizes.

Figures 34 and 35 show an alternative design for a clip 340. This clip 340 is substantially "E-shaped", with a back portion 341 and first, second and 5 third prongs 342A, 342B, 342C extending transverse from this back portion 341. The three prongs 342A, 342B, 342C are spaced apart along the length of the back portion 341. The first and third prongs 342A, 342C are provided with attachment clips 343A, 343B.

These attachment clips 343A, 343B can engage with the clasp 332 of a bra to provide the second cup size. Depending upon the orientation of the clip 300, one or the other of the attachment clips 343A, 343B will be used to attach the clasp 332 of the bra. By providing these clips 343A, 343B on both of the first and the third prongs 342A, 342C the clip is easily reversible so it can be used on either side of the bra. Preferably the clip 340 is also symmetrical, to aid the reversibility of the clip 340.

Figure 35 shows the clip 340 attached to a bra. As can be seen, the first and third prongs 342A, 342C extend on the front side of the bra strap, with the second prong 342B extending on the rear side of the bra strap. In this manner, the clip 340 is attached to the strap. In preferable embodiments, a grip-enhancing member 344 such as a number of projections and/or roughened patches can be provided on the second prong 342B in order to strengthen this grip.

In alternative embodiments, the attachment clip could be provided on the second, centremost prong 342B. In such an arrangement, the centremost prong 342B would be on the outside of the bra, with the first and third prongs 342A, 342C on the inside.

The provision of the attachable clip allows maternity bras already owned by the wearer to be quickly transformed into bras with quick switchable double cup size options.

This allows the use of integrated wearable breast pumps which increase the user's required cup size. This allows more design freedom for the breast pump in terms of size and shape, while still allowing the user to discretely pump with the pump held within their bra. By allowing conversion of the user's existing maternity bras, they are not forced to purchase specially designed bras to wear with the pump. The bra is hence normally at the first engagement point 330 when the breast pump device is not being used. As shown in Figure 33, the clasp 332 is then engaged by the user to discretely switch between the two configurations, and the user then inserts the pump without any complex adjustment or removal of clothing.

Preferably, the clip will be relatively unobtrusive in size and shape and hence can be left in place when the bra is first put on and used when necessary. To this end, the clip is preferably machine washable without significant damage or degradation.

In some embodiments, the clip may be switchable between positions for engaging with each cup so that a single clip may be used on either side of the bra. To achieve this, the clip is preferably reversible. This may provide the user with a visual indication of which breast has produced milk most recently so switching can take place.

In a preferred embodiment, the first engagement mechanism engages with the support structure in a first direction and the second engagement mechanism engages with the cup in a second direction transverse to the first direction. This increases ease of attachment as with this structure the sideways engagement of the clip to the support structure ensures that the second attachment mechanism is correctly orientated for the cup.

The second engagement mechanism may be one or more of a hook or a snap or a clip. This ensures easy interfacing with the traditional hook and clasp systems already provided on maternity bras.

Preferably the clip further comprises two distinct second engagement mechanisms which can be used interchangeably dependent upon the orientation of the clip. This makes the clip easier to use as it can be quickly switched between each bra strap, and the user does not have to worry which way up to put the clip on.

Preferably, the clip comprises a material pathway with an opening for receiving a portion of the support structure as the first engagement mechanism for securing the clip to the bra. This ensures a quick and simple method for attaching the clip to the bra. In particular, the clip may substantially U-shaped, and the material pathway is between the arms of the U.

Preferably, the clip comprises three prongs extending from a central support, the three prongs arranged as a central prong and two outer prongs so as to receive the support structure on one side of the central prong and on the opposite side of each respective outer prong, at least one prong being provided with the second engagement mechanism. This ensures a strong attachment to the bra and a simple design.

Preferably, both outer prongs are each provided with a respective second engagement mechanism. This ensures that the clip is reversible for easier attachment to the bra.

A method of adjusting the cup size of a maternity bra is provided according to the present invention, comprising: providing a maternity bra comprising: a support structure comprising shoulder straps and a bra band; and a first and second cup each attached to the support structure to provide a first cup size, the at least one cup being detachable from the support structure at an attachment point, providing a clip comprising first and section engagement mechanisms, attaching the first engagement mechanism of the clip in a releasable manner to a first position of the support structure of the maternity bra, attaching one of the detachable cup to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size.

This clip and method allow a user to quickly and simply adjust the cup size of a maternity bra to allow discrete and comfortable insertion and use of an integrated wearable breast pump.

Preferably, the method further comprises the step of inserting a breast pump into the detachable cup. The adjustment of the size of the bra allows the bra to support the breast pump against the user's breast for comfort and ease.

Preferably, the method further comprises the steps of: detaching the first engagement mechanism of the clip from the first position support structure of the maternity bra; attaching the first engagement mechanism of the clip in a releasable manner to a second position of the support structure of the maternity bra; and attaching the other of the detachable cups to the second engagement mechanism of the clip in a releasable manner to provide a second cup size different to the first cup size. This allows the user to use a single clip on either of the cups.

An alternative embodiment may be provided, with an extendable clip 360 as shown in Figure 36. In such an embodiment the clip is attached to the hook 331 on the strap 321 in a releasable manner, with the clasp 332 attached to an expandable portion of the clip. The clip is then able to expand between an unexpanded state where the clasp 332 is held in substantially the same position as the first attachment point 330 to provide the first cup size, and an expanded state, where the clasp 332 is held in a second position away from the first attachment point 330 to provide the second cup size.

For example, an elongate clip with first and second opposite ends may be provided. A first attachment point for attaching to the hook 331 is provided at the first end, and a second attachment point for attaching to the clasp 332 is provided at the second end. The elongate clip is hinged between the two ends, such that the clip can be folded between an elongate configuration to a closed configuration where the second end touches the first end. A clasp can be provided on the clip to hold the second end in this closed configuration. Thus, in the closed position the clasp 332 is held in substantially the same location as the first attachment point 330 to provide the first cup size, and in the open position the clasp is held away from the first attachment point 330 to provide the second cup size.

Other extendable clip embodiments are also possible, for example sliding clips or elastic clips.

Additional embodiments of a maternity bra adjuster are provided in Figures 37 and 38. The alternative proposed solution is a small adapter device, which comprises a first portion 370 including a clasp 373 and a second portion 372 including a hook 374, in which the first and second portions are separated by a small distance 371 in order to

provide two different adjustable sizes. The first portion includes a clasp 373 that is designed to attach to the hook on the bra strap 321. It may also include a top hook 375 positioned underneath the clasp, and a clip 376 on the rear side. The second portion includes a bottom hook 372.

The clasp 332 that is present on the cup 329 of the maternity bra, may then either engage with the top hook (321) to provide a first cup size, and engage with the bottom hook (332) to provide a second cup size that is different from the first cup size, as illustrated in Figure 39. The user may then discretely switch between a non pumping position, provided by the first cup size, and a second pumping position without any complex adjustment or removal of clothing needed, while using a wearable breast pump system (100).

The first portion and second portion may be made of plastic and may be separated by a stretchy material such as elastic or elastomeric material. The first portion may also include a clip on the rear side, the purpose of which is to allow the user to leave the clip attached to the bra for an extended time period.

Section D: Use of Piezo Pump in Wearables

As described in Section A, the breast pump system includes a piezo air pump, resulting in a fully wearable system that delivers a quiet, comfortable and discreet operation in normal use. This section gives further information on the piezo air pump.

In comparison with other pumps of comparable strength, piezo pumps are smaller, lighter and quieter. In operation, the Elvie breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise; tests indicate that it makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.

Piezo pumps also have lower current draw, allowing for increased battery life. A piezo pump is therefore ideally suited for wearable devices with its low noise, high strength and compact size. Further, as shown in the breast pump system of Figures 7 and 8, more than one piezo pump may be used.

Whilst a breast pump system is largely described in previous sections, the use of piezo mounted either in series or in parallel can also be implemented in any medical wearable devices or any wearable device. The piezo pump may pump air as well as any liquid.

With reference to Figure 40, a diagram illustrating a configuration of two piezo pumps mounted in series is shown.

With reference to Figure 41, a diagram illustrating a configuration of two piezo pumps mounted in parallel is shown.

With reference to Figure 42, the air pressure generated as a function of time by two piezo pumps mounted in series and two piezo pumps mounted in parallel are compared. In this example, the parallel configuration produces higher flow rate and achieves -100mmHg negative air pressure faster than the series configuration. In comparison, the series configuration produces lower flow rate and takes slightly longer to reach 100mmHg. However, the parallel configuration cannot achieve as high as a vacuum as the series configuration and plateaus at -140mmHg. In comparison, the series

configuration is able to generate about -240mmHg.

A dual configuration is also implemented in which more than one piezo pump is configured such that they can easily switch between a parallel mode and a series mode. This dual configuration would suit wearable devices that would need to achieve either lower or higher pressure faster.

Figure 43 shows a plot of the air pressure generated as a function of time by two piezo pumps mounted in a dual configuration. In this dual configuration, the piezo pumps first start with a parallel mode in order to benefit from faster flow rate, and then switch to a series mode (as indicated by the switch-over point) when stronger vacuums are required, enabling to save up to 500ms on cycle time with elastic loads.

Additionally, a piezo pump may be used in combination with a heat sink in order to efficiently manage the heat produced by the wearable pump. This configuration may be used to ensure that the wearable device can be worn comfortably. The heat sink or heat sinks are configured to ensure that the maximum temperature of any parts of the breast pump system that might come into contact with the skin (especially prolonged contact for greater than 1 minute) are no more than 48°C and preferably no more than 43°C.

The heat sink may store the heat produced by a piezo pump in order to help diverting the heat produced to another location. This not only ensures that the wearable system can be worn comfortably, but also increases the lifetime of a piezo pump.

Figure 44 shows a picture of a wearable breast pump housing including multiple piezo pumps (440). The breast pump system is wearable and the housing is shaped at least in part to fit inside a bra. By applying a voltage to the piezo pumps, the pressure provided by the pumps increase. The generation of higher pressure by the piezo pumps also means higher heat produced that needs to be managed. Each piezo pump is therefore connected to a heat sink (441), such as a thin sheet of copper. The heat sink has a long thermal path length that diverts the heat away from the piezo pump.

The use of a heat sink in combination with a piezo pump is particularly relevant when the wearable device is worn directly or near the body, and where the management of heat induced by the piezo pump is crucial.

A wearable device including a piezo pump may therefore include a thermal cut out, and may allow for excess heat to be diverted to a specific location. The heat sink may be connected to an air exhaust so that air warmed by the piezo pumps vents to the atmosphere. For example, the wearable system is a breast pump system and the heat sink stores heat, which can then be diverted to warm the breast shield of the breast pump system.

Use cases application include but are not limited to:

- Wound therapy;
- High degree burns;
- Sleep apnoea;
- Deep vein thrombosis;
- Sports injury.

APPENDIX: SUMMARY OF KEY FEATURES

In this section, we summarise the various features implemented in the Elvie™ pump system. We organize these features into six broad categories:

A. Elvie Breast Pump: General Usability Feature Cluster

B. Elvie Piezo Air Pump Feature Cluster

C. Elvie Milk Container Feature Cluster

D. Elvie IR System Feature Cluster

E. Elvie Bra Clip Feature Cluster

F. Other Features, outside the breast pump context

Drilling down, we now list the features for each category:

A. Elvie Breast Pump: General Usability Feature Cluster

Feature 1	Elvie is wearable and includes only two parts that are removable from the pump main housing in normal use.
Feature 2	Elvie is wearable and includes a clear breast shield giving an unobstructed view of the breast for easy nipple alignment.
Feature 3	Elvie is wearable and includes a clear breast shield with nipple guides for easy breast shield sizing.
Feature 4	Elvie is wearable and includes a breast shield that audibly attaches to the housing.
Feature 5	Elvie is wearable and includes a breast shield that attaches to the housing with a single push.
Feature 6	Elvie is wearable and not top heavy, to ensure comfort and reliable suction against the breast.
Feature 7	Elvie is wearable and has a Night Mode for convenience.

Feature 8	Elvie is wearable and includes a haptic or visual indicator showing when milk is flowing or not flowing well.
Feature 9	Elvie is wearable and collects data to enable the mother to understand what variables (e.g. time of day, pump speed etc.) correlate to good milk-flow.
Feature 10	Elvie is wearable and collects data that can be exported to social media.
Feature 11	Elvie is wearable and has a smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh.
Feature 12	A smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh.
Feature 13	Elvie is wearable and includes a sensor to infer the amount of movement or tilt angle during normal use.
Feature 14	Elvie includes a control to toggle between expressing milk from the left breast and the right breast.
Feature 15	Elvie includes a pressure sensor.
Feature 16	Elvie includes a microcontroller to enable fine tuning between pre-set pressure profiles.
Feature 17	Elvie enables a user to set the comfort level they are experiencing.
Feature 18	Elvie includes a microcontroller to dynamically and automatically alter pump operational parameters.
Feature 19	Elvie automatically learns the optimal conditions for let-down.

B. Elvie Piezo Air Pump Feature Cluster

Feature 20	Elvie is wearable and has a piezo air-pump for quiet operation.
Feature 21	Elvie has a piezo air-pump and self-sealing diaphragm
Feature 22	Elvie uses more than one piezo air pump in series.

Feature 23 Elvie is wearable and has a piezo air-pump, a breast shield and a diaphragm that fits directly onto the breast shield.

Feature 24 Elvie is wearable and has a piezo air-pump for quiet operation and a re-useable, rigid milk container for convenience.

Feature 25 Elvie has a piezo-pump for quiet operation and is a connected device.

Feature 26 Elvie uses a piezo in combination with a heat sink that manages the heat produced by the pump.

Feature 27 Elvie is wearable and gently massages a mother's breast using small bladders inflated by air from its negative pressure air-pump.

Feature 28 Elvie is wearable and gently warms a mother's breast using small chambers inflated by warm air from its negative pressure air-pump.

C. Elvie Milk Container Feature Cluster

Feature 29 Elvie is wearable and includes a re-useable, rigid milk container that forms the lower part of the pump, to fit inside a bra comfortably.

Feature 30 Elvie is wearable and includes a milk container that latches to the housing with a simple push to latch action.

Feature 31 Elvie is wearable and includes a removable milk container with an integral milk pouring spout for convenience.

Feature 32 Elvie is wearable and includes a removable milk container below the milk flow path defined by a breast shield for fast and reliable milk collection.

Feature 33 Elvie is wearable and includes a breast shield and removable milk container of optically clear, dishwasher safe plastic for ease of use and cleaning.

Feature 34 Elvie is wearable and includes various components that self-seal under negative air pressure, for convenience of assembly and disassembly.

Feature 35 Elvie is wearable and includes a spout at the front edge of the milk container for easy pouring.

Feature 36 Elvie is wearable and includes a milk container that is shaped with broad shoulders and that can be adapted as a drinking bottle that baby can easily hold.

D. Elvie IR System Feature Cluster

Feature 37 Elvie is wearable and includes a light-based system that measures the quantity of milk in the container for fast and reliable feedback.

Feature 38 The separate IR puck for liquid quantity measurement.

Feature 39 The separate IR puck combined with liquid tilt angle measurement.

E. Bra Clip Feature

Feature 40 Bra Adjuster.

F. Other Features that can sit outside the breast pump context

Feature 41 Wearable device using more than one piezo pump connected in series or in parallel.

Feature 42 Wearable medical device using a piezo pump and a heat sink attached together.

We define these features in terms of the device; methods or process steps which correspond to these features or implement the functional requirements of a feature are also covered.

We'll now explore each feature 1 – 41 in depth. Note that each feature can be combined with any other feature; any sub-features described as 'optional' can be combined with any other feature or sub-feature.

A. Elvie Breast Pump: General Usability Feature Cluster

Feature 1 Elvie is wearable and includes only two parts that are removable from the pump main housing in normal use

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) a breast shield;

(c) a rigid or non-collapsible milk container;

and in which the breast pump system includes only two parts that are directly removable from the housing in normal use or normal dis-assembly: the breast shield and the rigid, non-collapsible milk container.

Optional:

- The only parts of the system that come into contact with milk in normal use are the breast shield and the milk container.
- Milk only flows through the breast shield and then directly into the milk container.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The two removable parts are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and nipple tunnel shaped to receive a nipple.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings, in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- No other parts are removable from the breast shield, apart from the flexible diaphragm.
- The milk container attaches to a lower surface of the housing and forms the base of the breast pump system in use.
- The milk container mechanically or magnetically latches to the housing.
- The milk container is released by the user pressing a button on the housing.
- The milk container includes a removable cap and a removable valve that is seated on the lid.
- In normal use, the milk container is positioned entirely within a bra.

- No other parts are removable from the milk container, apart from the cap and the valve.
- All parts that are user-removable in normal use are attached to either the breast shield or the milk container.
- Audible or haptic feedback confirms the pump system is properly assembled for normal use with the milk container locked to the housing and the breast shield locked to the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 2 Elvie is wearable and includes a clear breast shield giving an unobstructed view of the breast for easy nipple alignment

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield including a substantially transparent nipple tunnel, shaped to receive a nipple, providing to the mother placing the breast shield onto her breast a clear and unobstructed view of the nipple when positioned inside the nipple tunnel, to facilitate correct nipple alignment.

Optional:

- The breast shield is configured to provide to the mother a clear and unobstructed view of the nipple when the breast shield is completely out, of or separated from, the housing.
- The breast shield is configured to provide to the mother a clear and unobstructed view of the nipple when the breast shield is partially out of, or partially separated from, the housing.
- Entire breast shield is substantially transparent.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- A milk container attaches to a lower surface of the housing and forms the base of the breast pump system in use.
- The milk container mechanically or magnetically latches to the housing.
- The milk container is released by the user pressing a button on the housing.

- The milk container includes a removable cap and a removable valve that is seated on the lid.
- In normal use, the milk container is positioned entirely within a bra.

Feature 3 Elvie is wearable and includes a clear breast shield with nipple guides for easy breast shield sizing

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield including a substantially transparent nipple tunnel shaped to receive a nipple, the nipple tunnel including guide lines that define the correct spacing of the nipple from the side walls of the nipple tunnel.

Optional:

- The guide lines run generally parallel to the sides of the nipple placed within the nipple tunnel.
- Breast shield is selected by the user from a set of different sizes of breast shield to give the correct spacing.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around the nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers in the housing locate into small indents in the breast shield.

- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 4 Elvie is wearable and includes a breast shield that audibly attaches to the housing.

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield that is attachable to the housing with a mechanism that latches with an audible click when the breast shield is slid on to or against the housing with sufficient force.

Optional:

- The breast shield is configured to slide onto or against the housing in a direction parallel to the long dimension of a nipple tunnel in the breast shield.

- Breast shield is removable from the housing with an audible click when the breast shield is pulled away from the housing with sufficient force.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around the nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b) transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- The edge of the flexible diaphragm seals, self-seals, self-energising seals, or interference fit seals against the housing when the breast shield attaches to the housing.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.

- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 5 Elvie is wearable and includes a breast shield that attaches to the housing with a single push

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield configured to attach to the housing with a single, sliding push action.

Optional:

- The breast shield is configured to slide onto or against the housing in a direction parallel to the long dimension of a nipple tunnel in the breast shield.
- The single push action overcomes a latching resistance.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into a nipple tunnel in the breast shield to position a diaphragm housing portion of the breast shield at the top of the breast.
- Housing is configured to slide onto the breast shield when the breast shield has been placed onto a breast using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.
- Breast shield includes or operates with a flexible diaphragm that (a) flexes when negative air pressure is applied to it by an air pump system in the housing, and (b)

transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.

- The edge of the flexible diaphragm seals, self-seals, self-energising seals, or interference fit seals against the housing when the breast shield attaches to the housing.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel includes on its lower surface an opening through which expressed milk flows.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- A milk container attaches to a lower surface of the housing and forms the base of the breast pump system in use.
- The milk container mechanically or magnetically latches to the housing.
- The milk container is released by the user pressing a button on the housing.
- The milk container includes a removable cap and a removable valve that is seated on the lid.
- In normal use, the milk container is positioned entirely within a bra.

Feature 6 Elvie is wearable and not top heavy, to ensure comfort and reliable suction against the breast

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism

(b) and a breast shield;

(c) a milk container;

and in which the centre of gravity of the pump system is, when the milk container is empty, substantially at or below (i) the half-way height line of the housing or (ii) the horizontal line that passes through a nipple tunnel or filling point on a breast shield, so that the device is not top-heavy for a woman using the pump.

Optional:

- The milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- In which the centre of gravity only moves lower during use as the milk container gradually receives milk, which increases the stability of the pump inside the bra.
- In which milk only passes downwards when moving to the milk container, passing through the nipple tunnel and then through an opening in the lower surface of the nipple tunnel directly into the milk container, or components that are attached to the milk container.
- System is configured so that its centre of gravity is no more than 60mm up from the base of the milk container also below the top of the user's bra cup.
- In which the pumping mechanism and the power supply for that mechanism are positioned within the housing to provide a sufficiently low centre of gravity.
- In which the pumping mechanism is one or more piezo air pumps, and the low weight of the piezo air pumps enables the centre of gravity to be substantially at or below (i) the half-way height line of the housing or (ii) the horizontal line that passes through the nipple tunnel or filling point on the breast shield.
- In which the pumping mechanism is one or more piezo air pumps, and the small size of the piezo air pumps enables the components in the housing to be arranged so that the centre of gravity is substantially at or below (i) the half-way height line of the housing or (ii) the horizontal line that passes through the nipple tunnel or filling point on the breast shield.
- In which the pumping mechanism is one or more piezo air pumps, and the low weight of the battery or batteries needed to power that piezo air pumps enables the centre of gravity to be substantially at or below (i) the half-way height line of

the housing or (ii) the horizontal line that passes through the nipple tunnel or filling point on the breast shield.

- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 7 Elvie is wearable and has a Night Mode for convenience

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) an illuminated control panel;

(c) a control system that reduces or adjusts the level or colour of illumination of the control panel at night or when stipulated by the user.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Control system is implemented in hardware in the pump itself using a 'night mode' button.
- Control system is implemented in software within a connected device app running on the user's smartphone.
- Control system is linked to the illumination level on a connected device app., so that when the connected app is in 'night mode', the illuminated control panel is also in 'night mode', with a lower level of illumination, and when the illuminated control panel on the housing is in 'night mode', then the connected app is also in 'night mode'.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast. The pumping mechanism is one or more piezo air pumps, selected for quiet operation.

Feature 8 Elvie is wearable and includes a haptic or visual indicator showing when milk is flowing or not flowing well

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) a milk container that is configured to be concealed within a bra and is hence not visible to the mother in normal use;

(c) a visual and/or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

Optional:

- A haptic and/or visual indicator indicates if the pump is operating correctly to pump milk, based on whether the quantity and/or the height of the liquid in the container above its base is increasing above a threshold rate of increase
- The visual indicator is a row of LEDs that changes appearance as the quantity of liquid increases.
- The haptic and/or visual indicator provides an indication of an estimation of the flow rate.
- The visual indicator provides a colour-coded indication of an estimation of the flow rate.
- The visual indicator provides an indication of how much of the container has been filled.
- The visual indicator is part of a user interface in a connected, companion application, running on a smartphone or other personal device, such as a smart watch or smart ring.
- The haptic indicator is part of a user interface in a connected, companion application, running on a smartphone or other personal device, such as a smart watch or smart ring.
- A sub-system measures or infers the quantity and/or the height of the liquid in the container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect

light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.

- Sub-system includes or communicates with an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- A sub-system measures or infers the angle the top surface of the liquid in the container makes with respect to a baseline, such as the horizontal.
- A haptic and/or visual indicator indicates if the amount of milk in the milk container has reached a preset quantity or level.
- A haptic and/or visual indicator indicates if there is too much movement of the breast pump system for viable operation.
- Milk container is attached to the lower part of the housing and forms the base of the breast pump system.
- Milk container is made of transparent material.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 9 Elvie is wearable and collects data to enable the mother to understand what variables (e.g. time of day, pump speed etc.) correlate to good milk-flow

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) a milk container;

(c) a measurement sub-system that measures or infers milk flow into the milk container;

and in which the measurement sub-system provides data to a data analysis system that determines metrics that correlate with user-defined requirements for milk-flow rate or milk expression.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- User-defined requirement is to enhance or increase milk-flow.
- User-defined requirement is to reduce milk-flow.
- The data analysis system analyses data such as any of the following: amount of milk expressed over one or more sessions, rate at which milk is expressed over one or more sessions, profile of the rate at which milk is expressed over one or more sessions.
- The data analysis system determines metrics such as any of the following: pump speed, length of a single pumping session, negative air pressure or vacuum level, peak negative air pressure or vacuum level, pump cycle time or frequency, changing profile of pump speed over a single pumping session time of day.
- The data analysis system determines metrics such as any of the following: amount and type of liquids consumed by the mother, state of relaxation of the mother before or during a session, state of quiet experienced by the mother before or during a session, what overall milk expression profile the mother most closely matches.
- Data analysis system is local to the breast pump system, or runs on a connected device, such as a smartphone, or is on a remote server or is on the cloud, or is any combination of these.
- measurement sub-system measures or infers the quantity and/or the height of the liquid in the container above its base.
- Measurement sub-system measures or infers angle the top surface of the liquid in the container makes with respect to a baseline, such as the horizontal.
- Data analysis system gives recommended metrics for improving milk flow
- Data analysis system gives recommended metrics for weaning.
- Data analysis system gives recommended metrics for increasing milk supply (e.g. power pumping).
- Data analysis system gives recommended metrics if an optimal session start time or a complete session has been missed.

- Data analysis system leads to automatic setting of metrics for the pumping mechanism, such as pump speed, length of a single pumping session, vacuum level, cycle times, changing profile of pump speed over a single pumping session.
- Data analysis system enables sharing across large numbers of connected devices or apps information that in turn optimizes the milk pumping or milk weaning efficacy of the breast pump.
- Metrics include the specific usage of the connected device by a woman while using the pump (for example by the detection of vision and/or audio cues).
- The measurement sub-system measures or infers the quantity and/or the height of the liquid in the container.
- The measurement sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.
- The measurement sub-system includes or communicates with an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the measurement sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- Milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 10 Elvie is wearable and collects data that can be exported to social media.

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) a milk container;

(c) a data sub-system that collects and provides data to a connected device or remote application or remote server;

(d) and in which the collected data, in whole or in part, is used by a data analysis system that provides inputs to a social media or community function or platform.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- The data analysis system analyses metrics such as any of the following: amount of milk expressed over one or more sessions, rate at which milk is expressed over one or more sessions, profile of the rate at which milk is expressed over one or more sessions.
- The data analysis system analyses metrics such as any of the following: pump speed, length of a single pumping session, negative air pressure or vacuum level, peak negative air pressure or vacuum level, pump cycle time or frequency, changing profile of pump speed over a single pumping session time of day.
- The data analysis system analyses metrics such as any of the following: amount and type of liquids consumed by the mother, state of relaxation of the mother before or during a session, state of quiet experienced by the mother before or during a session, what overall milk expression profile the mother most closely matches.
- Data analysis system is local to the breast pump system, or runs on a connected device, such as a smartphone, or is on a remote server or is on the cloud, or is any combination of these.
- The social media or community function or platform organizes the collected data into different profiles.
- The social media or community function or platform enables a user to select a matching profile from a set of potential profiles.
- each profile is associated with a specific kind of milk expression profile, and provides information or advice that is specifically relevant to each milk expression profile.
- Information or advice includes advice on how to increase milk expression by varying parameters, such as time of milk expression, frequency of a milk

expression session, pump speed, length of a single pumping session, vacuum level, cycle times, changing profile of pump speed over a single pumping session and any other parameter that can be varied by a mother to help her achieve her milk expression goals.

- The application is connected to other applications residing on the connected device, such as a fitness app.
- The collected data includes data received from other connected apps.
- The collected data is anonymised before it is shared.
- The sub-system includes a wi-fi connectivity component for direct connectivity to a remote server.
- The milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 11 Elvie is wearable and has a smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh

A breast pump system including a pumping mechanism and a milk container and including:

(a) a housing including the pumping mechanism;

(b) a milk container;

(c) and in which the milk container or any associated part, such as a lid, includes a memory or tag that is automatically programmed to store the time and/or date it was filled with milk.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Memory or tag is programmed to store the quantity of milk in the milk container.
- Memory or tag stores the milk expiry date.

- Memory or tag stores a record of the temperature of the milk or the ambient temperature around the milk, and calculates an expiry date using that temperature record.
- System includes a clock and writes the time and/or date the milk container was filled with milk to the memory or tag on the milk container.
- Clock is in the housing.
- Clock is in the milk container.
- Milk container includes a display that shows the time and/or date it was filled with milk.
- Milk container includes a display that shows the quantity of milk that it was last filled with milk.
- Milk container includes a display that shows whether the left or right breast was used to fill the milk container.
- Memory or tag is connected to a data communications sub-system.
- Memory or tag is a remotely readable memory or tag, such as a NFC tag, enabling a user to scan the milk container with a reader device, such as a smartphone, and have the time and/or date that container was filled with milk, displayed on the reader device.
- Reader device shows the time and/or date a specific milk container was filled with milk.
- Reader device shows the quantity of milk that a specific milk container was last filled with.
- Reader device shows the time and/or date and/or quantity that each of several different milk containers were filled with.
- Reader device shows whether the left or right breast was used to fill the milk contained in a specific milk container.
- A sub-system measures or infers milk flow into the milk container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.

- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/Tr the height of the liquid in the container.
- The sub-system is in the housing.
- Milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.
- Pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 12 A smart bottle that stores the time and/or date of pumping to ensure the milk is used when fresh.

A smart bottle or container that includes or is associated with a memory or a tag that is programmed to store the date and time it is filled using data from a pump or a connected device, such as a smartphone.

Optional:

- The container includes wireless connectivity and connects to a companion app.
- The memory or tag includes an NFC chip and is read using a NFC reader.
- The memory or tag stores also an expiry date.
- Memory or tag stores a record of the temperature of the milk or the ambient temperature around the milk, and calculates an expiry date using that temperature record.
- The memory or tag stores also the quantity of milk stored.
- System includes a clock and writes the time and/or date the milk container was filled with milk to the memory or tag on the milk container.
- Clock is in the housing.
- Clock is in the container.
- Milk container includes a display that shows the time and/or date it was filled with milk.
- Milk container includes a display that shows the quantity of milk that it was last filled with milk.

- Milk container includes a display that shows whether the left or right breast was used to fill the milk contained.
- Milk container includes a display that shows the expiry date.
- memory or tag is connected to a data communications sub-system.
- Memory or tag is a remotely readable memory or tag, such as a NFC tag, enabling a user to scan the milk container with a reader device, such as a smartphone.
- Reader device shows the time and/or date a specific milk container was filled with milk.
- Reader device shows the quantity of milk that a specific milk container was last filled with.
- Reader device shows the time and/or date and/or quantity that each of several different containers were filled with.
- Reader device shows whether the left or right breast was used to fill the milk contained in a specific milk container.
- Reader device shows the expiry date.
- Container includes wireless connectivity and connects to a companion application.
- An application tracks status of one or more smart containers and enables a user to select an appropriate smart container for a feeding session.
- The pump is wearable.
- The pump is in a housing shaped to fit inside a bra and the container is a milk container that is connected to the housing and is positioned to form the base of the housing.
- Container is used for liquids other than milk.

Feature 13 Elvie is wearable and includes a sensor to infer the amount of movement or tilt angle during normal use.

A breast pump system including:

(a) a housing;

(b) a milk container;

(c) the housing including a sensor, such as an accelerometer, that measures or determines the movement and/or tilt angle of the housing, during a pumping session and automatically affects or adjusts the operation of the system depending on the output of the sensor.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- If the tilt angle of the housing exceeds a threshold, then the system automatically affects the operation of the system by warning or alerting the mother of a potential imminent spillage (e.g. from milk flowing back out of a breast shield) using an audio, or visual or haptic alert, or a combination of audio, haptic and visual alerts.
- If the tilt angle of the housing exceeds a threshold, then the system automatically adjusts the operation of the system by stopping the pump to prevent spillage.
- When the tilt angle of the housing reduces below the threshold, the system automatically adjusts the operation of the system by causing pumping to resume automatically.
- If the tilt angle of the housing exceeds a threshold, then the system automatically affects the operation of the system by providing the mother with an alert to change position.
- The container includes an optically clear region.
- There are one or more light emitters and detectors positioned in the base of the housing, the light emitters and receivers operating as part of a sub-system that measures or infers the tilt angle of the milk in the container.
- The sub-system measures the quantity of liquid in the milk container and also takes the measured tilt angle of the housing into account.
- If the tilt angle is above a certain threshold, the system ignores the quantity of liquid measured.
- The sub-system derives or infers the mother's activity, such as walking, standing or lying activities, from the sensor.
- The milk container is a re-useable milk container that when connected to the housing is positioned to form the base of the housing.

- Sub-system stores a time-stamped record of movement and/or tilt angles of the housing in association with milk flow data.
- System includes a breast shield that attaches to the housing.
- System includes a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 14 Elvie includes a control to toggle between recording whether milk is being expressed from the left breast and the right breast.

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a control interface that the user can select to indicate or record if milk is being expressed from the left or the right breast.

Optional:

- Control interface is a physical interface on the housing.
- Control interface is a single button on the housing.
- Control interface is from an application running on a device, such as a smartphone or smart ring.
- Visual indicators on the housing indicate whether the breast pump system is being set up the left or the right breast.
- The visual indicator for the left breast is on the right-hand side of the housing, when viewed from the front; and the visual indicator for the right breast is on the left-hand side of the housing, when viewed from the front.
- The housing includes a button labeled to indicate the left breast and a button labeled to indicate the right breast, that are respectively illuminated to indicate from which breast the milk is being expressed.
- Breast pump system is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 15 Elvie includes a pressure sensor.

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) an air pressure sensor configured to measure the negative pressure delivered by the negative air-pressure mechanism and (iii) a measurement sub-system that measures or infers milk flow or milk volume.

Optional:

- The system also includes a control sub-system that combines or relates the air-pressure measurements with the milk flow or milk volume measurements
- The control sub-system automatically adjusts the negative air-pressure to give the optimal milk flow or milk volume.
- The control sub-system automatically adjusts the negative air-pressure during a pumping session to give the optimal milk flow or milk volume within comfort constraints defined by the user.
- The air pressure sensor detects pressure created by the pumping mechanism.
- Sensor is a piezo air pressure sensor
- Air pressure sensor measures the negative air pressure during a normal milk expression session.
- Air pressure sensor measures the negative air pressure during a calibration session, and the system uses the results to vary the operation of the pumping mechanism so that it deliver consistent performance over time.
- Air pressure sensor measures the negative air pressure during a calibration session, and the system uses the results to vary the operation of the pumping mechanism so that different pumping mechanisms in different breast pump systems all deliver consistent performance
- Air pressure sensor measures the negative air pressure during a calibration session, and the system uses the results to determine if the pumping mechanism is working correctly, within tolerance levels.
- The operation of the pumping mechanism is varied by altering the duty or pump cycle.
- The operation of the pumping mechanism is varied by altering the voltage applied to the pumping mechanism.
- Pumping mechanism is a piezo air pump.

- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 16 Elvie includes a microcontroller to enable fine tuning between pre-set pressure profiles

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to cause the pumping mechanism to deliver various pre-set pressure profiles and to permit the user to manually vary the pressure to a value or values that are in-between the values available from a pre-set pressure profile.

Optional:

- The user manually varies the pressure using a control interface on a housing of the breast pump system
- The user manually varies the pressure using a control interface on an application running on a wireless device such as a smartphone that is wirelessly connected to the breast pump system.
- The user manually varies the pressure by altering a control parameter of the pumping mechanism.
- The user manually varies the pressure by altering the duty cycle or timing of the

pumping mechanism.

- The user manually varies the pressure by altering the voltage applied to the pumping mechanism.
- The system includes an air pressure sensor configured to measure the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.
- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Pressure profile defines one or more maximum negative air pressure levels.
- Pressure profile defines one or more maximum negative air pressure levels, each for a pre-set time.
- Pressure profile defines one or more cycle time.
- Pressure profile defines peak flow rate.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 17 Elvie enables a user to set the comfort level they are experiencing

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to control the pumping mechanism and to permit the user to manually indicate the level of comfort that they are experiencing when the system is in use.

Optional:

- The user manually indicates the level of comfort that they are experiencing using a touch or voice-based interface on a housing of the breast pump system
- The user manually indicate the level of comfort that they are experiencing using a touch or voice-based interface on an application running on a wireless device, such as a smartphone, that is wirelessly connected to the breast pump system.
- The system stores user-indicated comfort levels together with associated parameters of the pumping system.
- The system is a connected device and a remote server stores user-indicated comfort levels together with associated parameters of the pumping system.
- The parameters of the pumping system include one or more of: pumping strength, peak negative air pressure; flow rate; voltage applied to the pumping mechanism; duty or timing cycle of the pumping mechanism.
- System automatically varies parameters of the pumping system and then enables the user to indicate which parameters are acceptable.
- System includes an air pressure sensor that measures the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.
- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the

intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 18 Elvie includes a microcontroller to dynamically and automatically alter pump operational parameters

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to automatically change one or more parameters of the pumping mechanism, and to automatically measure or relate milk expression data as a function of different values of one or more of these parameters.

Optional:

- The milk expression data includes one or more of the following: milk expression rate or quantity; comfort; optimal pumping mode; optimal pumping mode given remaining battery power.
- The system automatically calculates or identifies the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity and uses that set of parameters.
- The system automatically calculates or identifies the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity and uses that set of parameters if the comfort experienced by the user when those parameters are used is above a threshold.
- The system displays the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity to the user.
- The system displays the parameters of the pumping mechanism that correlate with maximum milk expression rate or quantity to the user and enables the user to manually select those parameters if they are acceptable.
- Parameters of the pumping mechanism includes pumping strength, peak negative air pressure; flow rate; voltage applied to the pumping mechanism; duty or timing cycle of the pumping mechanism.
- System includes an air pressure sensor that measures the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.

- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

Feature 19 Elvie automatically learns the optimal conditions for let-down

A breast pump system including (i) a pumping mechanism that applies negative air-pressure and (ii) a microcontroller programmed to dynamically change one or more parameters of the pumping mechanism, and to automatically detect the start of milk let-down.

Optional:

- The microcontroller is programmed to dynamically change one or more parameters of the pumping mechanism, to enable it to learn or optimize the parameters relating to milk let-down.
- The system automatically calculates or identifies or learns the parameters of the pumping mechanism that correlate with the quickest start of milk let-down.
- The system automatically calculates or identifies or learns the parameters of the pumping mechanism that correlate with the quickest start of milk let-down and uses that set of parameters if the comfort experienced by the user when those

parameters are used is above a threshold or are otherwise acceptable to the user.

- The system displays the parameters of the pumping mechanism that correlate with the quickest start of milk let-down to the user.
- The system displays the parameters of the pumping mechanism that correlate with the quickest start of milk let-down and enables the user to manually select those parameters if they are acceptable.
- parameters of the pumping mechanism includes pumping strength, peak negative air pressure; flow rate; voltage applied to the pumping mechanism; duty or timing cycle of the pumping mechanism.
- System includes an air pressure sensor that measures the negative air pressure delivered by the pumping mechanism.
- The air pressure sensor is a piezo air pressure sensor.
- Pumping mechanism is a piezo air pump.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a flexible diaphragm that seals, self-seals, self-energising seals or interference fit seals against a diaphragm housing that forms part of a breast shield.
- Breast pump system is wearable and includes a housing that is shaped at least in part to fit inside a bra.
- Breast pump system includes a milk container and a measurement sub-system that automatically measures the quantity of milk in the milk container.
- The measurement sub-system includes one or more light emitters and one or more light detectors, operating as part of a sub-system that measures or infers the quantity of the milk in the container and/or the height of the milk in the container above its base, and in which the light detectors detect and measure the intensity of the light from the emitters that has been reflected from the surface of the milk.

B. Elvie Piezo Air Pump Feature Cluster

Feature 20 Elvie is wearable and has a piezo air-pump for quiet operation

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a piezo air-pump in the housing that is part of a closed loop system that drives, a separate, deformable diaphragm to generate negative air pressure.

Optional:

- The deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The closed system is separated from a ‘milk’ side by a flexible diaphragm.
- Deformable diaphragm is removably mounted against a part of a breast shield.
- Deformable diaphragm is a unitary or one-piece object that is removably mounted against a part of a breast shield.
- Deformable diaphragm is not physically connected to the piezo air-pump.
- Piezo air-pump is a closed loop air-pump that drives a physically separate and remote deformable diaphragm that removably fits directly onto the breast shield
- Deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 25gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.

- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise. The piezo pump is fed by air that passes through an air filter.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 21 Elvie has a piezo air-pump and self-sealing diaphragm

A breast pump system including:

(a) a housing;

(b) a piezo air-pump in the housing that is part of a closed loop system that drives, a physically separate, deformable, self-sealing diaphragm, to generate negative air pressure.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement .
- The closed system is separated from a 'milk' side by the flexible diaphragm.
- Deformable diaphragm is removably mounted against a part of a breast shield.
- Deformable diaphragm is a unitary or one-piece object that is removably mounted against a part of a breast shield.
- Deformable diaphragm is not physically connected to the piezo air-pump.
- Piezo air-pump is a closed loop air-pump that drives a physically separate and remote deformable diaphragm that removably fits directly onto the breast shield.
- Deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the

diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.

- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- The piezo pump is fed by air that passes through an air filter.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 22 Elvie uses more than one piezo air pump in series

A breast pump system including:

(a) a housing;

(b) multiple piezo air-pumps in the housing that drives a deformable diaphragm inside the housing to generate negative air pressure; in which the multiple piezo air-pumps can be operated at different times in series-connected and in parallel-connected modes.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Parallel connected mode is used during a first part of a pumping cycle to reach a defined negative air pressure more quickly than series connected mode would, and then the system switches to a series connected mode to reach a greater negative air pressure than series connected mode can reach.
- An actuator switches the system from parallel-connected piezo pump mode to series-connected piezo pump mode.

- Each piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- Each piezo air pump weighs less than 10 gm, and may weigh less than 6gm..
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- Each piezo pump is fed by air that passes through an air filter.
- Each piezo air pump forms part of a closed or closed loop system.
- Each piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- The piezo-air pumps are a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.

Feature 23 Elvie is wearable and has a piezo air-pump, a breast shield and a diaphragm that fits directly onto the breast shield

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a breast shield that attaches to the housing;

(b) a piezo air-pump in the housing that drives a deformable diaphragm that fits directly onto the breast shield.

Optional:

- Deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Deformable diaphragm is removable from the diaphragm housing for cleaning.

- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Piezo air pump forms part of a closed or closed loop system.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- Piezo air pump is position at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum. power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.The piezo pump is fed by air that passes through an air filter.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The breast shield and milk container are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.

Feature 24 Elvie is wearable and has a piezo air-pump for quiet operation and a re-useable, rigid milk container for convenience

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra;

(b) a piezo air-pump in the housing;

(c) and a re-useable, rigid or non-collapsible milk container that when connected to the housing forms an integral part of the housing and that is also removable from the housing.

Optional:

- Piezo air pump forms part of a closed or closed loop system.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The closed system is separated from a 'milk' side by a flexible diaphragm.

- A deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- The deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- The deformable diaphragm is removable from the diaphragm housing for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel in the breast shield includes an opening on its lower surface that is positioned through which expressed milk flows directly into the milk container.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.

Feature 25 Elvie has a piezo-pump for quiet operation and is a connected device

A breast pump system including

(a) a housing;

(b) a piezo air-pump in the housing;

(c) a milk container;

(d) a data connectivity module that enables data collection relating to the operation of the piezo air-pump and transmission of that data to a data analysis system.

Optional:

- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Transmission is to an application running on a connected device such as a smartphone, or a server, or the cloud.
- The data collection and transmission relates to any other operational data of the system.
- Piezo air pump forms part of a closed or closed loop system.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- The closed system is separated from a 'milk' side by a flexible diaphragm.
- A deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.

- The deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- Deformable diaphragm is removable from the diaphragm housing for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel in the breast shield includes an opening on its lower surface that is positioned through which expressed milk flows directly into the milk container.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 10 gm, and may weigh less than 6gm.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.
- A sub-system measures or infers the quantity and/or the height of the liquid in the container and shares that data with the data connectivity module.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.
- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- The data analysis system analyses metrics such as any of the following: amount of milk expressed over one or more sessions, rate at which milk is expressed over one or more sessions, profile of the rate at which milk is expressed over one or more sessions.
- The data analysis system analyses metrics such as any of the following: pump speed, length of a single pumping session, negative air pressure or vacuum level,

peak negative air pressure or vacuum level, pump cycle time or frequency, changing profile of pump speed over a single pumping session time of day.

- The data analysis system analyses metrics such as any of the following: amount and type of liquids consumed by the mother, state of relaxation of the mother before or during a session, state of quiet experienced by the mother before or during a session, what overall milk expression profile the mother most closely matches.

Feature 26 Elvie uses a piezo in combination with a heat sink that manages the heat produced by the pump.

A breast pump system including:

(a) a housing;

(b) a piezo air-pump in the housing that drives a deformable diaphragm inside the housing to generate negative air pressure;

(c) a heat sink to manage the heat produced by the piezo-air pump to ensure it can be worn comfortably.

Optional:

- The heat sink is configured to ensure that the maximum temperature of any parts of the breast pump system that might come into contact with the skin, especially prolonged contact for greater than 1 minute, are no more than 48°C and preferably no more than 43°C.
- The breast pump is wearable and the housing is shaped at least in part to fit inside a bra.
- Heat sink is connected to an air exhaust so that air warmed by the piezo pumps vents to the atmosphere.
- Heat sink warms a breast shield.
- Piezo air pump forms part of a closed or closed loop system.
- Piezo air pump is positioned at or close to the base of the housing.
- There are two or more piezo air pumps.

- There are two or more piezo air pumps, each connected to its own or a shared heat sink.
- There are two or more piezo air pumps mounted in a series arrangement.
- There are two or more piezo air pumps mounted in a parallel arrangement.
- The piezo-air pump is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.
- The piezo air-pump is a closed loop negative air-pressure system that drives a physically separate and remote deformable, self-sealing diaphragm that removably fits directly onto the breast shield.
- The closed system is separated from a 'milk' side by a flexible diaphragm.
- A deformable diaphragm inside the housing is driven by negative air pressure generated by the piezo pump.
- The deformable diaphragm is a flexible generally circular diaphragm that sits over a diaphragm housing that is an integral part of a breast shield.
- The deformable diaphragm is removable from the diaphragm housing for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- Nipple tunnel in the breast shield includes an opening on its lower surface that is positioned through which expressed milk flows directly into the milk container.
- The piezo pump delivers in excess of 400mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow.
- The piezo air pump weighs less than 25g.
- In operation, the breast pump system makes less then 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.
- In operation, the breast pump system makes approximately 24dB noise at maximum power and 22dB at normal power, against a 20dB ambient noise.

Feature 27 Elvie is wearable and gently massages a mother's breast using small bladders inflated by air from its negative pressure air-pump

A breast pump system including:

(a) a housing;

(b) an air-pump in the housing that drives a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast;

(c) in which the air pump also provides air to regularly or sequentially inflate one or more air bladders or liners that are configured to massage one or more parts of the breast.

Optional:

- Air-pump is a piezo pump.
- Breast pump system is wearable and the housing is shaped at least in part to fit inside a bra.
- Bladders or liners are formed in a breast shield that attaches to the housing.

Feature 28 Elvie is wearable and gently warms a mother's breast using small chambers inflated by warm air from its negative pressure air-pump

A breast pump system including:

(a) a housing;

(b) an air-pump, such as a piezo pump, in the housing that drive a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast;

(c) in which the air pump also provides warm air to regularly or sequentially inflate one or more air chambers that are configured to apply warmth to one or more parts of the breast.

Optional:

- Breast pump system is wearable and the housing is shaped at least in part to fit inside a bra.
- The air chamber is a deformable diaphragm positioned on a breast shield that attaches to the housing.

C. Elvie Milk Container Feature Cluster

Feature 29 Elvie is wearable and includes a re-useable, rigid milk container that forms the lower part of the pump, to fit inside a bra comfortably

A wearable breast pump system configured including:

(a) a housing shaped at least in part with a curved surface to fit inside a bra and including a pumping mechanism;

(b) and a re-useable rigid or non-collapsible milk container that when connected to the housing forms an integral, lower part of the housing, with a surface shaped to continue the curved shape of the housing, so that the pump system can be held comfortably inside the bra.

Optional:

- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is attached to the housing with a push action.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture, spout or lid that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a

breast shield, and milk flows under gravity through the opening into the milk container.

- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump mechanism to ensure that negative air-pressure is not applied to the milk container.
- The pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 30 Elvie is wearable and includes a milk container that latches to the housing with a simple push to latch action

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a milk container that is attachable to the housing with a mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.

Optional:

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- Milk container, when connected to the housing, forms an integral, lower part of the housing and that is removable from the housing with a release mechanism that can be operated with one hand.

- Mechanism that releasably attaches or latches is a mechanical or magnetic mechanism.
- Mechanical mechanism includes flanges on the top of the milk container, or the sealing plate that seals the opening to the milk contained, that engage with and move past a surface to occupy a latched position over that surface when the milk container is pressed against the housing to lock into the housing.
- The housing includes a button that when pressed releases the milk container from the housing by flexing the surface away from the flanges so that the flanges no longer engage with and latch against the surface.
- Mechanism that attaches or latches the milk container into position does so with an audible click.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing by releasing the latch and moving the housing off the milk container.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container.
- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container.

- The pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 31 Elvie is wearable and includes a removable milk container with an integral milk pouring spout for convenience

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a re-useable milk container that is connected to the housing with a surface shaped to continue the curved or breast-like shape of the pump, so that the pump can be held comfortably inside a bra and where the milk container includes a pouring spout for pouring milk.

Optional:

- Spout is integral to the milk container.
- Spout is integral to a removable lid to the milk container.
- Spout is positioned at or close to the front edge of the milk container.
- Spout is removable from the container, such as by clipping off the container.
- A teat is attachable to the spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.

- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container through the pouring spout in the milk container.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- The pumping mechanism is a closed loop negative air-pressure system that applies negative pressure to a region surrounding a woman's breast to pump milk form that breast.

Feature 32 Elvie is wearable and includes a removable milk container below the milk flow path defined by a breast shield for fast and reliable milk collection

A wearable breast pump system including:

(a) a housing including a pumping mechanism, the housing being shaped at least in part to fit inside a bra;

(b) and a breast shield including a nipple tunnel shaped to receive a nipple, and including an opening that defines the start of a milk flow path;

(c) a re-useable milk container that when connected to the housing is positioned entirely below the opening or the milk flow path, when the breast pump is positioned or oriented for normal use.

Optional:

- The milk container includes an aperture that sits directly underneath the opening in the nipple tunnel in the breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container through the pouring spout in the milk container.
- Milk flows from the opening directly into the milk container.
- Milk flows from the opening directly into the milk container.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against the opening in the breast shield, and milk flows under gravity through the opening into the milk container.
- Milk flows from the opening directly onto a valve that is attached to the milk container, the valve closing whilst there is sufficient negative air pressure in the volume of air between the valve and the breast shield opening, and then opening to release the milk into the container when the air pressure rises sufficiently.
- Milk flows from the opening directly onto a valve that is attached to a spout, that is in turn attached to the milk container.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.
- A flexible rubber or elastomeric valve is mounted onto the milk container cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container, and milk flows towards and is retained by the duck bill valve whilst the valve is closed, and flows past the valve into the milk container when the negative air pressure is released and the valve opens.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The two removable parts are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.

- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.

Feature 33 Elvie is wearable and includes a breast shield and removable milk container of optically clear, dishwasher safe plastic for ease of use and cleaning

A breast pump system including:

(a) a housing including a pumping mechanism;

(b) and a breast shield defining a region shaped to receive a nipple, the region defining the start of a milk flow path;

(c) a re-useable, rigid or non-collapsible milk container that when connected to the housing is positioned to form the base of the housing;

and in which the breast shield and the milk container are made substantially of an optically clear, dishwasher safe material.

Optional:

- The material is a polycarbonate material, such as Tritan™.

- breast pump system is wearable and the housing is shaped at least in part to fit inside a bra.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield operates with a flexible diaphragm that flexes when negative air pressure is applied to it by an air pump system in the housing, and transfers that negative air-pressure to pull the breast and/or nipple against the breast shield to cause milk to be expressed.
- Flexible diaphragm is removable from a diaphragm housing portion of the breast shield for cleaning.
- Diaphragm housing includes an air hole that transfers negative air pressure to a nipple tunnel in the breast shield, the negative air pressure arising when the diaphragm moves away from the diaphragm housing and towards the housing, and the negative air pressure in the nipple tunnel pulling the breast and/or nipple against the breast shield to cause milk to be expressed.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The breast shield and milk container are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.

- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.
- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.

Feature 34 Elvie is wearable and includes various components that self-seal under negative air pressure, for convenience of assembly and disassembly

A wearable breast pump system including:

(a) a housing shaped at least in part to fit inside a bra and including an air pumping mechanism;

(b) a breast shield;

(c) a diaphragm that flexes in response to changes in air pressure caused by the air pumping mechanism and that seals to the breast shield;

(d) a re-useable milk container that seals to the breast shield;

and in which either or both of the diaphragm and the re-useable milk container substantially self-seal under the negative air pressure provided by the pumping mechanism.

Optional:

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a

breast shield, and milk flows under gravity through the opening into the milk container.

- The re-useable milk container includes a 1 way valve that self-seals against a conduit from the breast shield and allows milk to pass into the container but not spill out, and in which the valve (a) closes and (b) partly or wholly self-seals against the conduit under the negative air pressure provided by the pumping mechanism.
- The 1 way valve is attached to the milk container, or a lid or spout of the milk container with an interference fit and is readily removed in normal use for separate cleaning.
- The diaphragm partly or wholly self-seals to the breast shield under the negative air pressure provided by the pumping mechanism.
- The diaphragm partly or wholly self-seals to the housing under the negative air pressure provided by the pumping mechanism.
- The diaphragm is attached to the diaphragm housing using elastomeric or rubber latches and is readily removed in normal use for separate cleaning.
- The breast shield and milk container are each pressed or pushed into engagement with the housing.
- The breast shield and milk container are each pressed or pushed into a latched engagement with the housing.
- The breast shield and milk container are each insertable into and removable from the housing using an action confirmed with an audible sound, such as a click.
- Breast shield is a one-piece item including a generally convex surface shaped to fit over a breast and a nipple tunnel shaped to receive a nipple.
- Breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use.
- Breast shield is configured to be rotated smoothly around a nipple inserted into the nipple tunnel to position a diaphragm housing portion of the breast shield at the top of the breast.
- Breast shield slides into the housing using guide members.
- Housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
- Breast shield latches into position against the housing.

- Breast shield latches into position against the housing when spring plungers, such as ball bearings in the housing locate into small indents in the breast shield.
- Breast shield latches into position against the housing using magnets.

Feature 35 Elvie is wearable and includes a spout at the front edge of the milk container for easy pouring

A wearable breast pump system configured as a single unit and including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a milk container that forms an integral part of the housing;

(c) a re-useable pouring spout that is positioned at or close to the front edge of the milk container.

Optional:

- Milk container is a multifunctional bottle, operating as both a storage container to contain milk that is being expressed, as well as a refrigeratable and freezable storage bottle for that milk, as well as a bottle from which that milk can be drunk by a baby.
- Spout is integral to a removable lid to the milk container.
- Spout is removable from the container, such as by clipping off the container.
- A teat is attachable to the spout.
- By placing the spout at or close to the front edge of the milk container, the milk container fully empties more readily than where the spout is placed in the middle of the lid of a milk container.
- The spout sits generally under an opening in the breast shield spout or nipple tunnel through which expressed milk flows.
- The re-useable milk container includes a 1 way valve that self-seals against a conduit from the breast shield and allows milk to pass into the container but not spill out, and in which the valve (a) closes and (b) partly or wholly self-seals against the conduit under the negative air pressure provided by the pumping mechanism.

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.

Feature 36 Elvie is wearable and includes a milk container that is shaped with broad shoulders and that can be adapted as a drinking bottle that baby can easily hold

A wearable breast pump system configured as a single unit and including:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) a breast shield;

(c) a milk container that is removable from the housing and is shaped or configured to also serve as a drinking bottle that is readily held by a baby because it is wider than it is tall.

Optional:

- Teat is attachable directly to the milk container.
- Pouring or drinking spout is integral to the milk container.
- The shoulders are at least 2cm in width, and the neck is no more than 1 cm in height, to enable a baby to readily grip and hold the container when feeding from the milk in the container.
- Spout/teat/straw resides near the edge of the container's rim.
- Milk container is a multifunctional bottle, operating as both a storage container to contain milk that is being expressed, as well as a refrigertable and freezable storage bottle for that milk, as well as a bottle from which that milk can be drunk by a baby.
- The re-useable milk container includes a 1 way valve that self-seals against a conduit from the breast shield and allows milk to pass into the container but not spill out, and in which the valve (a) closes and (b) partly or wholly self-seals

against the conduit under the negative air pressure provided by the pumping mechanism.

- The milk container includes an aperture, spout or lid that self-seals under the negative air-pressure from the pumping mechanism against an opening in a breast shield, and milk flows under gravity through the opening into the milk container.
- Spout is integral to the milk container.
- Spout is integral to a removable lid to the milk container.
- Spout is positioned at or close to the front edge of the milk container.
- Spout is removable from the container, such as by clipping off the container.
- A teat is attachable to the spout.
- A flexible rubber or elastomeric valve is mounted onto the cap or spout and includes a rubber or elastomeric duck-bill valve that stays sealed when there is negative air-pressure being applied by the air pump to ensure that negative air-pressure is not applied to the milk container.
- The milk container forms the base of the system.
- The milk container has a flat base so that it can rest stably on a surface.
- The milk container is removable from the housing.
- The milk container includes a clear or transparent wall or section to show the amount of milk collected.
- The milk container is sealable for storage.
- The milk container obviates the need for consumable or replaceable milk pouches.
- The milk container includes an aperture that sits directly underneath an opening in a nipple tunnel of a breast shield, and expressed milk flows under gravity through the opening in the nipple tunnel and into the milk container through the pouring spout in the milk container.
- The milk container is made using a blow moulding construction.
- The milk container has a large diameter opening to facilitate cleaning that is at least 3cm in diameter.
- The large opening is closed with a bayonet-mounted cap with an integral spout.

D. Elvie IR System Feature Cluster

Feature 37 Elvie is wearable and includes a light-based system that measures the quantity of milk in the container for fast and reliable feedback

A system for milk volume determination, for use as part of a breast pump, or breast milk collecting device, including:

(a) a re-useable rigid or non-collapsible milk container;
(b) at least one light emitter, configured to direct radiation towards the surface of the milk;
(c) at least one light detector, configured to detect reflected radiation from the surface of the milk;

wherein the light emitters and detectors operate as part of a sub-system that measures the height of, or infers the quantity of, the milk in the container.

Optional:

The wearable breast pump system includes:

(a) a housing shaped at least in part to fit inside a bra and including a pumping mechanism;

(b) and a breast shield;

(c) a re-useable rigid or non-collapsible milk container that when connected to the housing is positioned to form the base of the housing;

and in which the top of the container includes an optically clear region that is aligned below one or more light emitters positioned in the base of the housing.

- The sub-system measures or infers the quantity and/or the height of the liquid in the container by using one or more light emitters and light detectors to detect light from the emitters that has been reflected by the liquid, and measuring the intensity of that reflected light.
- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.

- The sub-system measures or infers the quantity and/or the height of the liquid in the container and shares that data with a data connectivity module.
- Where the quantity or level exceeds a threshold, then the pumping mechanism automatically changes mode, e.g. from a stimulation mode to an expression mode.
- Where the quantity or level exceeds a threshold, then the pumping mechanism automatically stops.
- Milk-flow data is captured and stored.
- If milk-flow falls below a threshold, then a notification is provided to the mother.

Feature 38 The separate IR puck for liquid quantity measurement

A liquid-level measuring system for measuring the quantity of liquid in a container for a breast pump; the system including:

(a) one or more light emitters directing light at the surface of the liquid in the container;

(b) one or more light receivers configured to detect light from the light emitters that has been reflected from the liquid;

(c) a sub-system that infers, measures or calculates the quantity in the liquid using measured properties of the detected light;

(d) a collar or other fixing system that positions the system over the container.

Optional:

- The quantity of milk is measured as milk enters the container or as milk is removed from the container.
- Measured property includes the reflected light intensity

Feature 39 The separate IR puck combined with liquid tilt angle measurement

A liquid-level measuring system for measuring the tilt angle of liquid in a container; the system including:

(a) one or more light emitters directing light at the surface of the liquid in the container;

(b) one or more light receivers configured to measure properties of the light reflected from the liquid;

(c) a sub-system including an accelerometer that infers, measures or calculates the tilt angle of the liquid using measured properties of the detected light;

(d) a collar or other fixing system that positions the system over the container.

Optional:

- Measured property includes the reflected light intensity
- The quantity of liquid is measured as liquid enters the container or as liquid is removed from the container.
- Sub-system includes an accelerometer and uses a signal from the accelerometer to determine if the liquid is sufficiently still to permit the sub-system to accurately measure or infer the quantity and/or the height of the liquid in the container.
- The sub-system measures or infers the quantity and/or the height of the liquid in the container and shares that data with a data connectivity module.

Generally applicable optional features

- Weight of the entire unit, unfilled, is under 250g and preferably 214g.
- Silver based bactericide is used on all parts that are not steam or heat sterilized in normal cleaning.
- Housing includes a rechargeable battery.
- System is self-contained.
- System is a closed loop system.
- Breast pump system is a self-contained, wearable device that includes an integral rechargeable battery, control electronics, and one or more air pumps operating as a closed system, driving a flexible diaphragm that in turn delivers negative air-pressure to the breast, to cause milk to be expressed.
- Housing has a generally rounded or convex front surface and has a generally tear-drop shape when seen from the front.

E. Bra Clip Feature Cluster

Feature 40 Bra Adjuster

A bra adjuster for a nursing or maternity bra, the nursing or maternity bra including a bra cup with a flap that can be undone to expose the nipple, and the flap attaching to the shoulder strap using a clasp, hook or other fastener attached to the flap, and a corresponding fastener attached to the shoulder strap;

and in which the bra adjuster is attachable at one end to the fastener attached to the flap, and at its other end to the fastener attached to the shoulder strap, and hence increases the effective bra cup size sufficiently to accommodate a wearable breast pump, and is also detachable from the flap and shoulder strap.

Optional:

- Bra adjuster is retained in position on the bra during normal wearing of the bra, even when the flap is attached directly to the shoulder strap, and is used to increases the effective bra cup size only when the wearable breast pump is used.
- Bra adjuster is extensible or elastic.
- Bra adjuster is of a fixed length.
- Bra adjuster includes a clip that the user can slide onto the bra strap to secure the bra adjuster in position.
- Bra adjuster is machine-washing washable.

F. Other Features that can sit outside the breast pump context

Feature 41 Wearable device using more than one piezo pump connected in series or in parallel

A wearable device including multiple piezo pumps mounted together either in series or in parallel.

Optional:

- The wearable device is a medical wearable device.
- The piezo pumps air or any liquid etc.
- The system can switch between a parallel mode and a series mode to arrive to lower or higher pressure quicker.

Feature 42 Wearable medical device using a piezo pump and a heat sink attached together.

A wearable medical device including a piezo pump and a heat sink attached together.

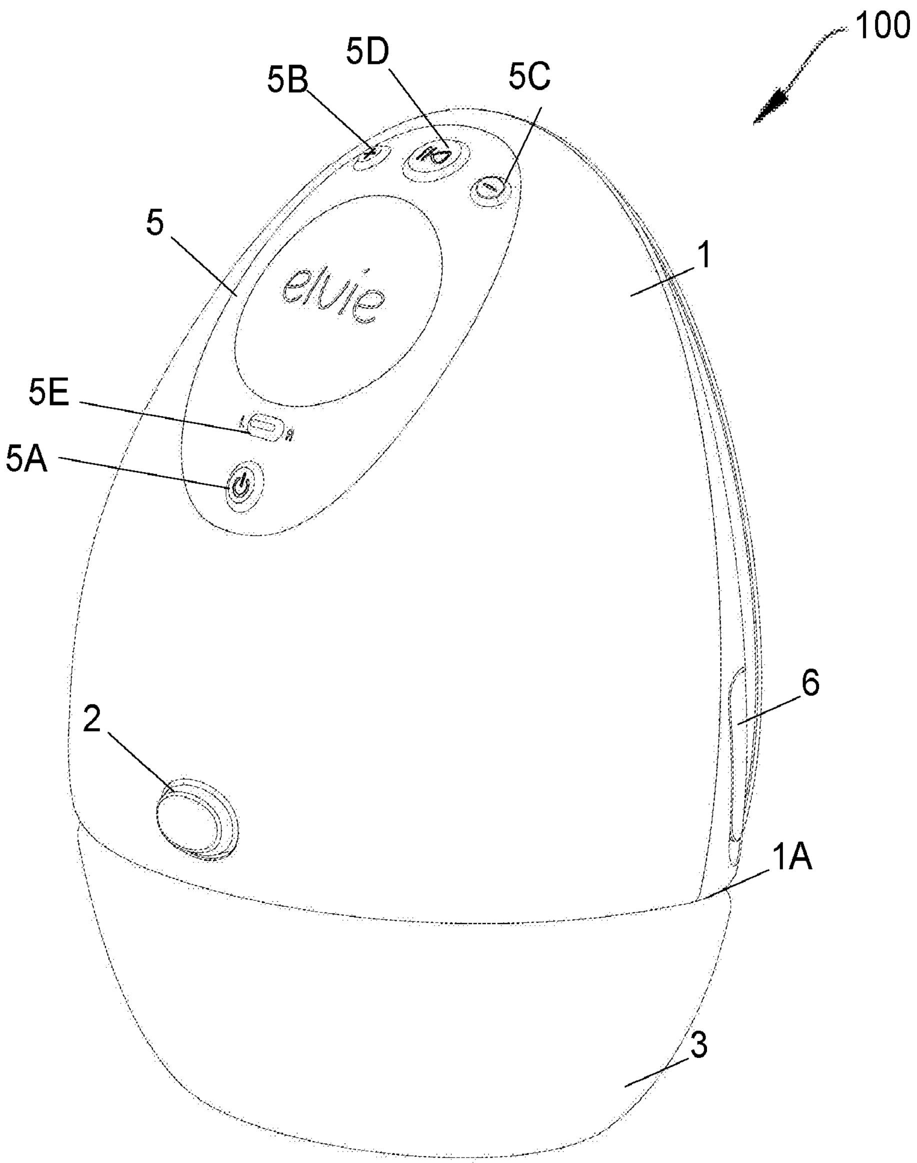
Optional

- The wearable device uses more than one piezo pump connected in series.
- The wearable device uses more than one piezo pump connected in parallel.
- Each piezo pump is connected to its own heat sink, or to a common heat sink.
- The or each heat sink is configured to ensure that the maximum temperature of any parts of the breast pump system that might come into contact with the skin, especially prolonged contact for greater than 1 minute, are no more than 48°C and preferably no more than 43°C
- The wearable device includes a thermal cut out.
- Excess heat is diverted to a specific location on the device that is selected to not be in prolonged contact with the skin of the user, in normal use.
- Use cases application:
    - Wound therapy
    - High degree burns
    - Sleep apnea
    - Deep vein thrombosis
    - Sports injury.
- Wearable medical device is powered/charged via USB.

Note

It is to be understood that the above-referenced arrangements are only illustrative of the application for the principles of the present invention. Numerous modifications and alternative arrangements can be devised without departing from the spirit and scope of

the present invention. While the present invention has been shown in the drawings and fully described above with particularity and detail in connection with what is presently deemed to be the most practical and preferred example(s) of the invention, it will be apparent to those of ordinary skill in the art that numerous modifications can be made without departing from the principles and concepts of the invention as set forth herein.



1/44

FIGURE 1

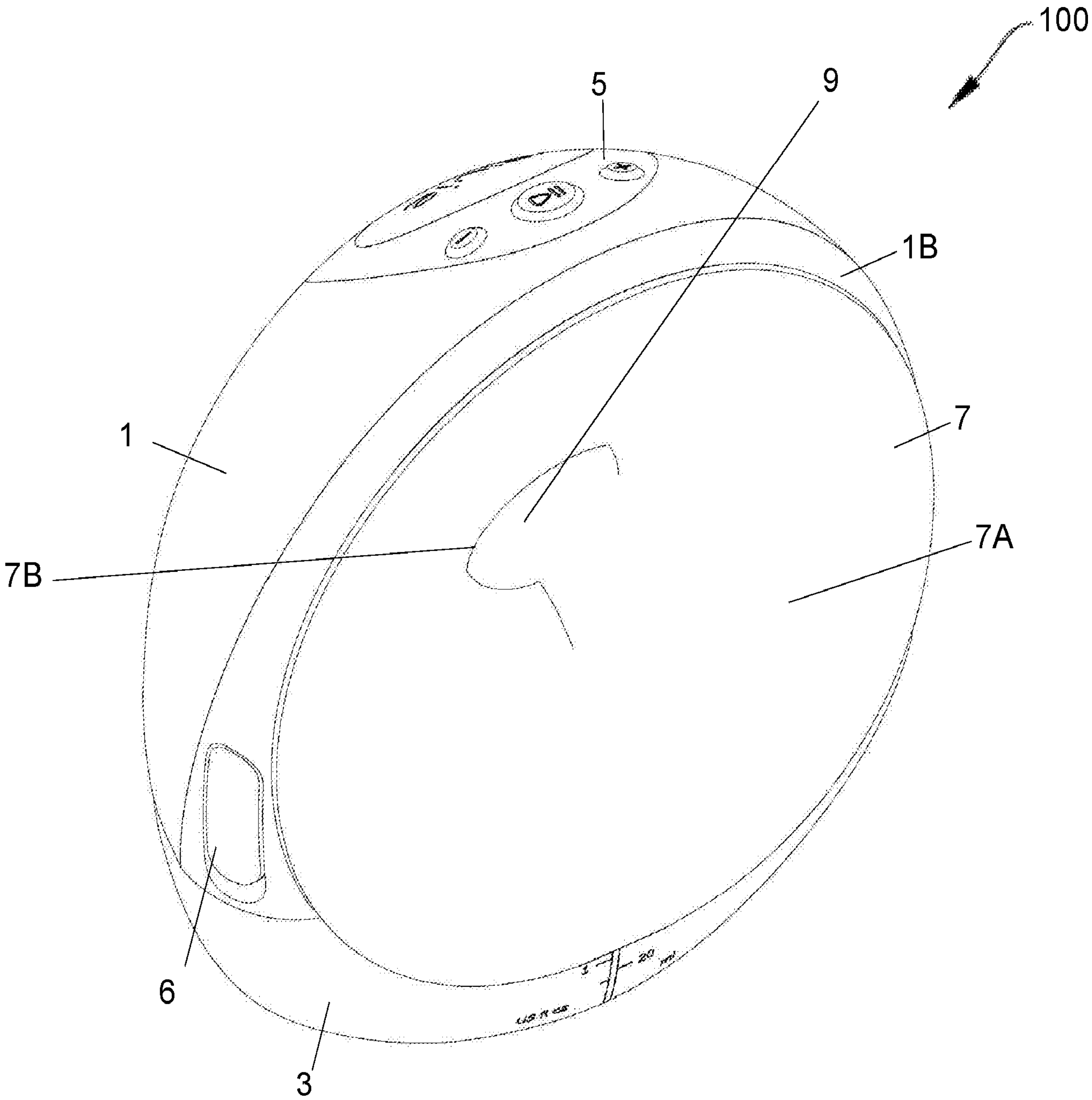
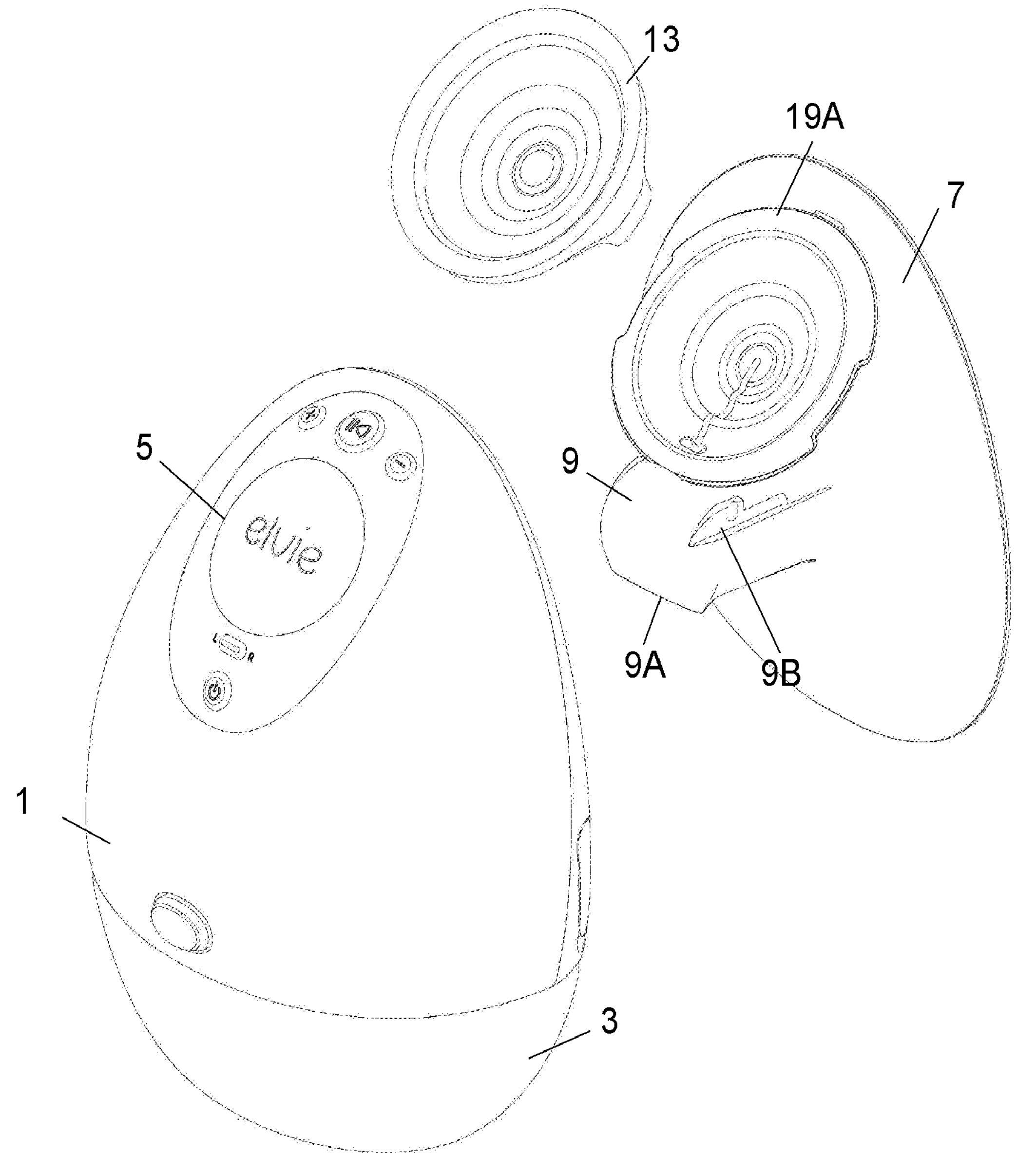


FIGURE 2



3/44

FIGURE 3

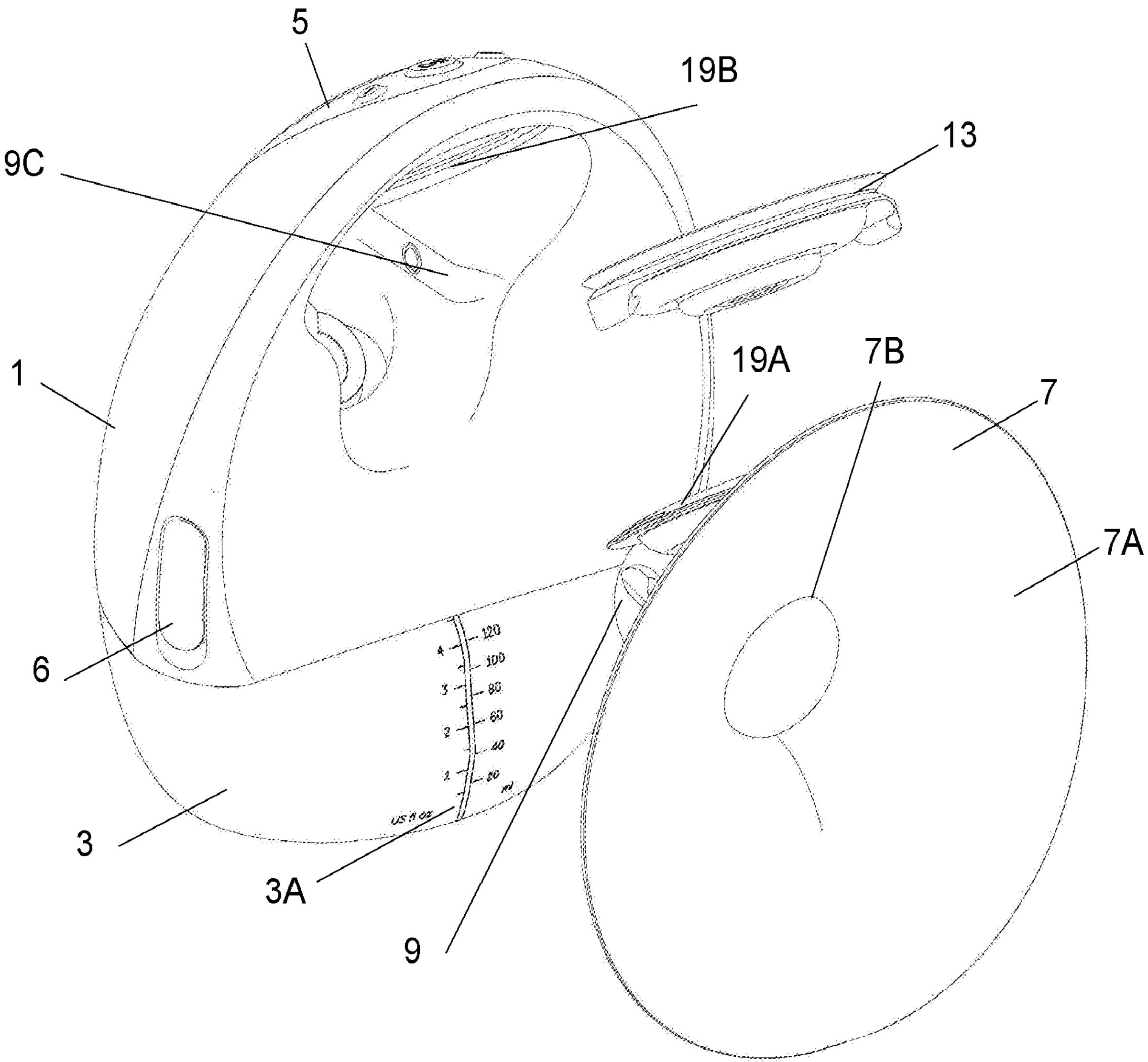


FIGURE 4

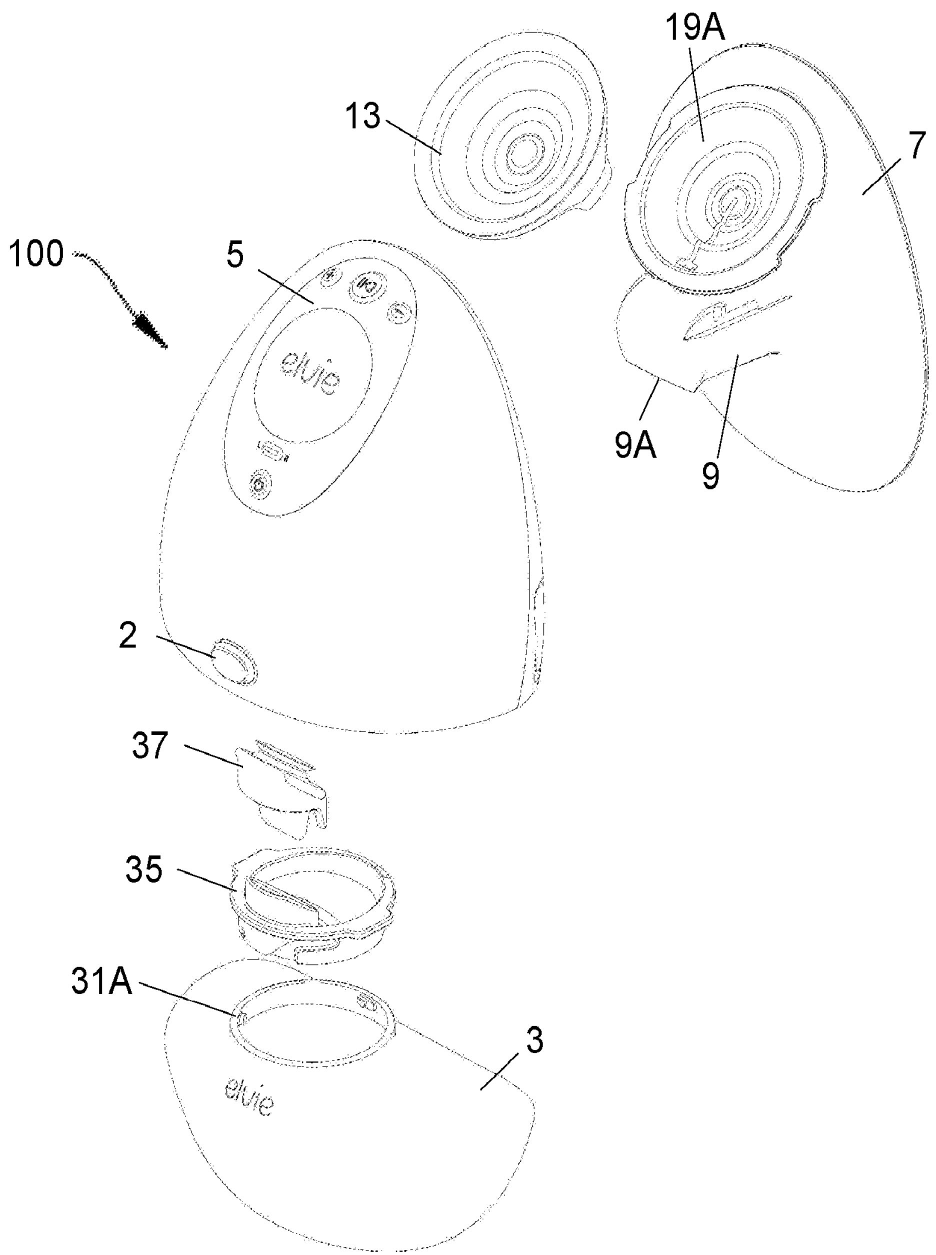


FIGURE 5

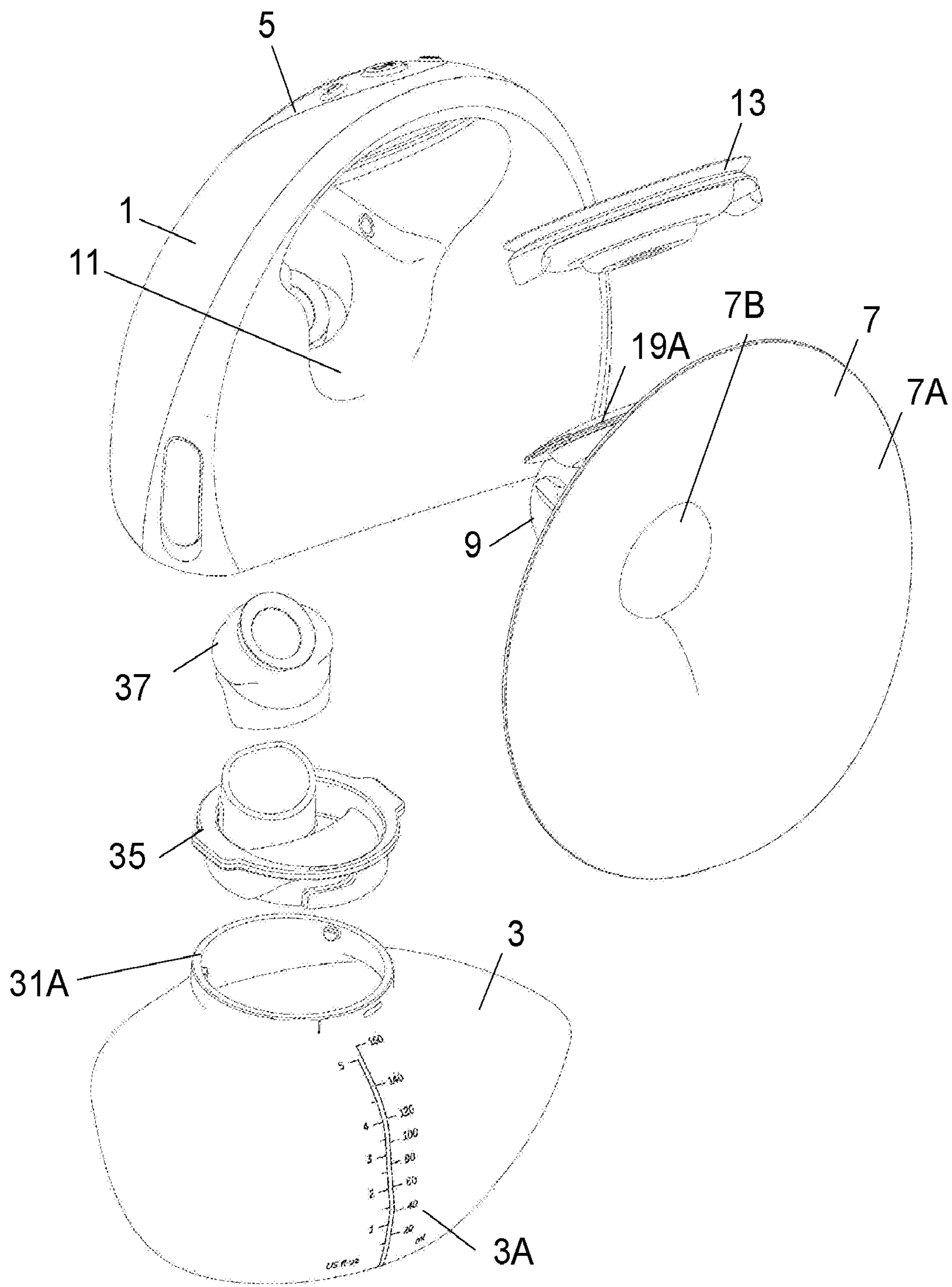


FIGURE 6

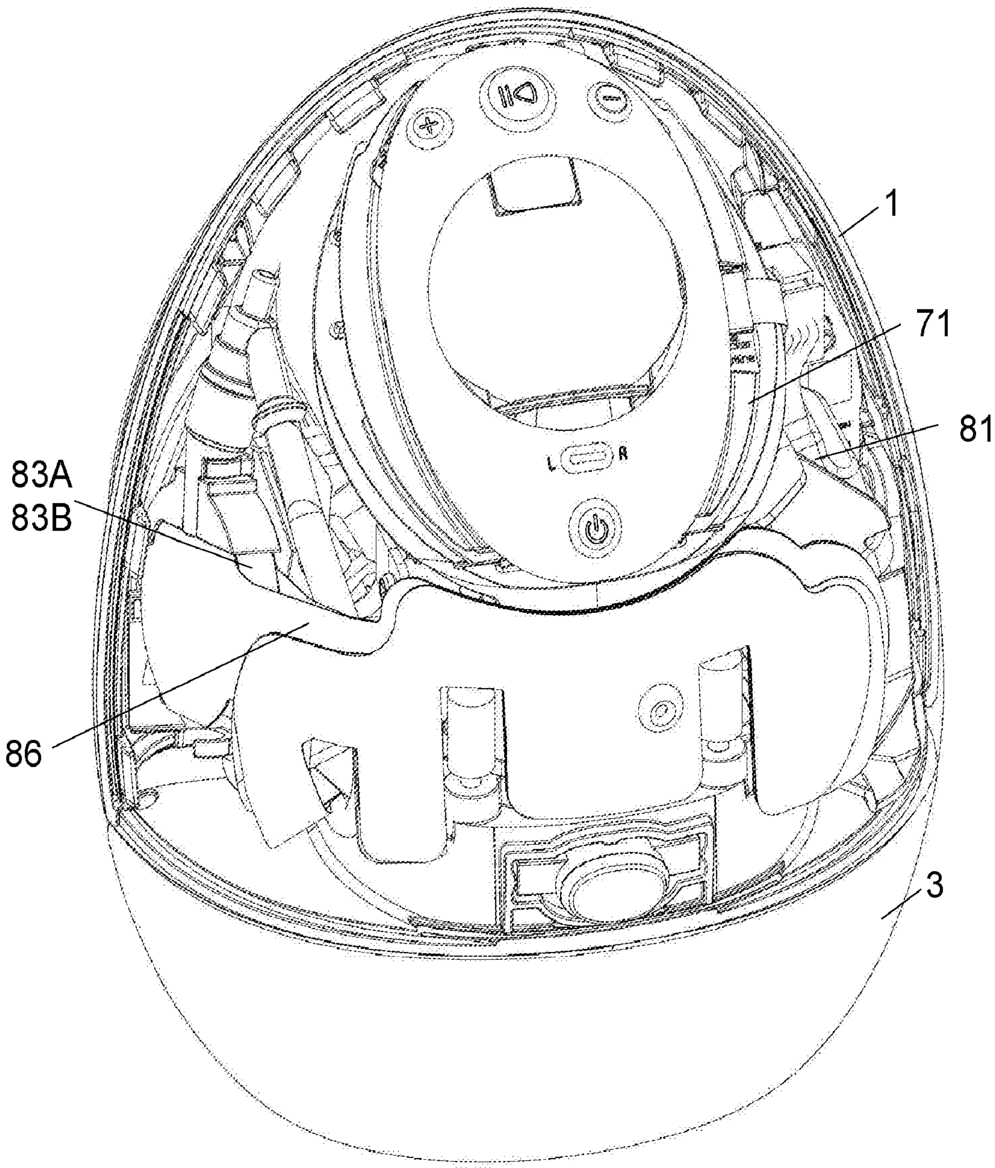
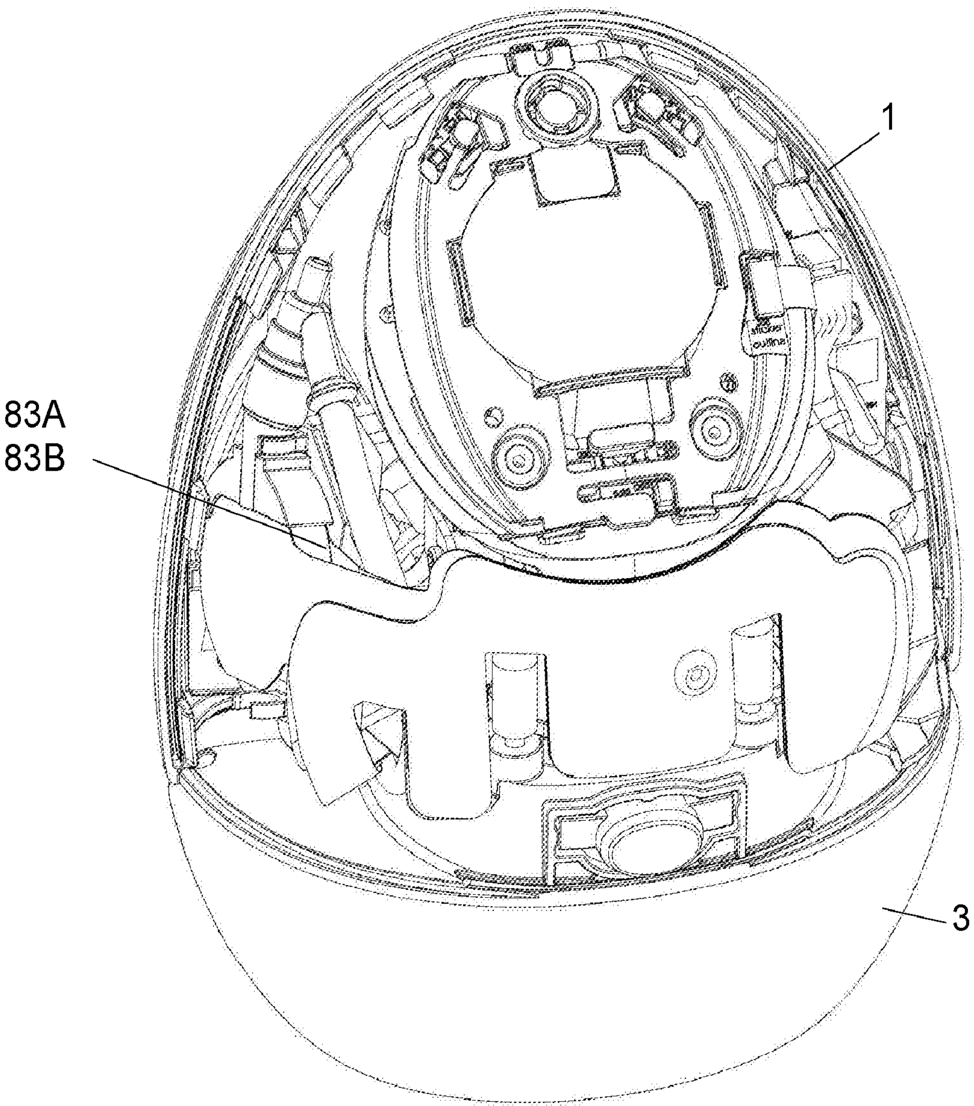


FIGURE 7



8/44

FIGURE 8

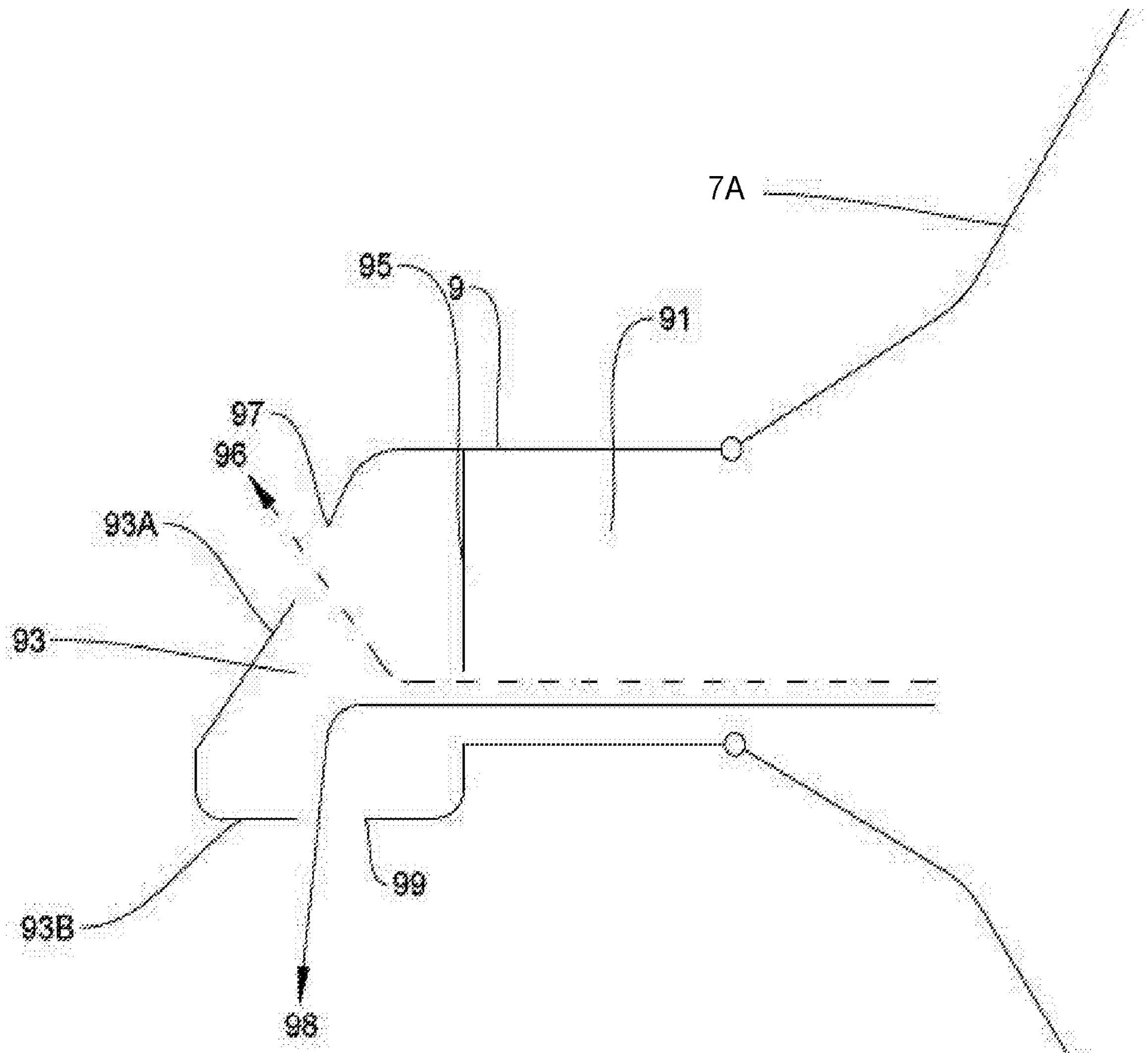


FIGURE 9

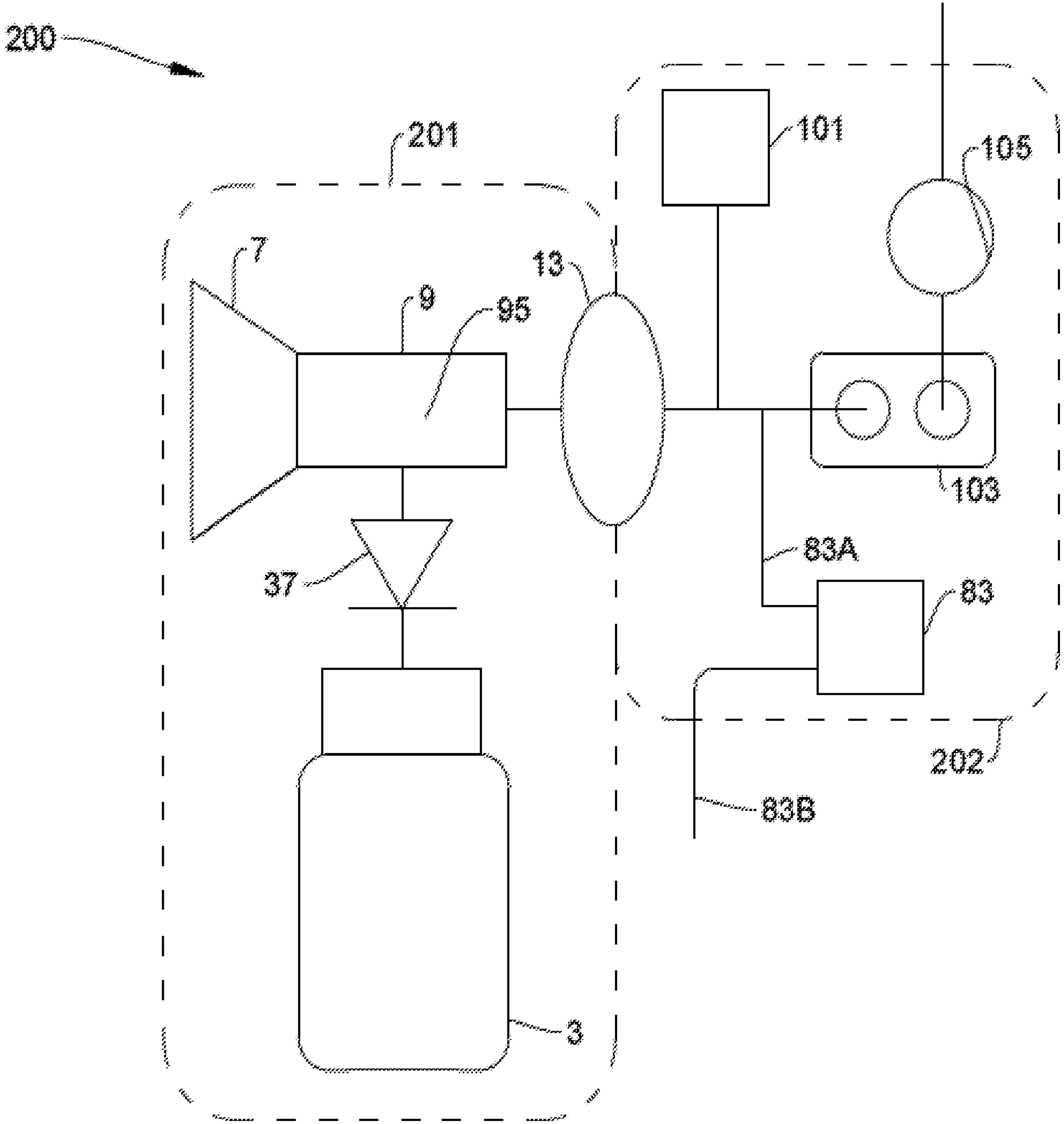


FIGURE 10

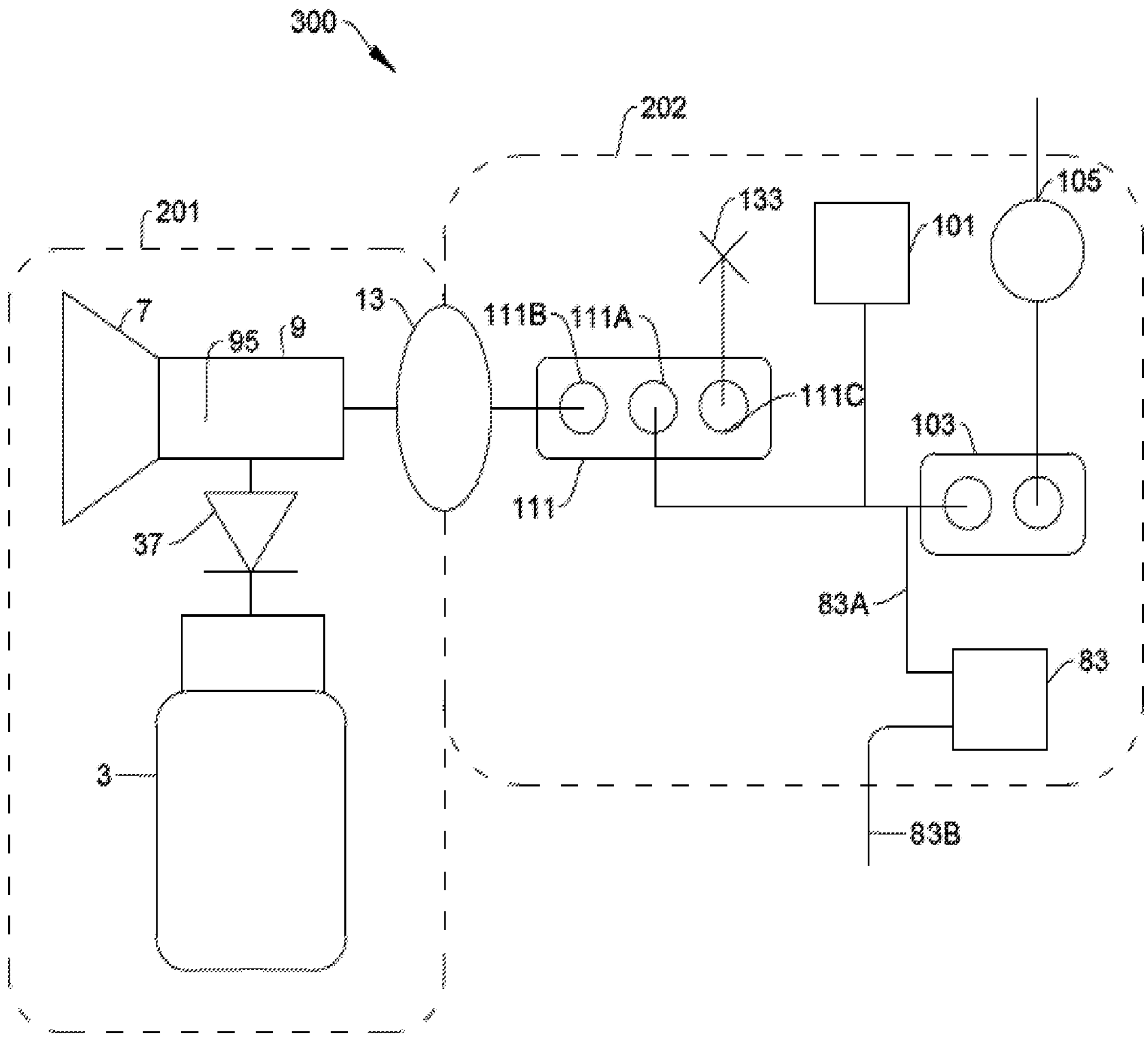

300
202
201
133
101
105
7
9
95
13
111B
111A
111C
103
111
37
83A
83
3
83B

FIGURE 11

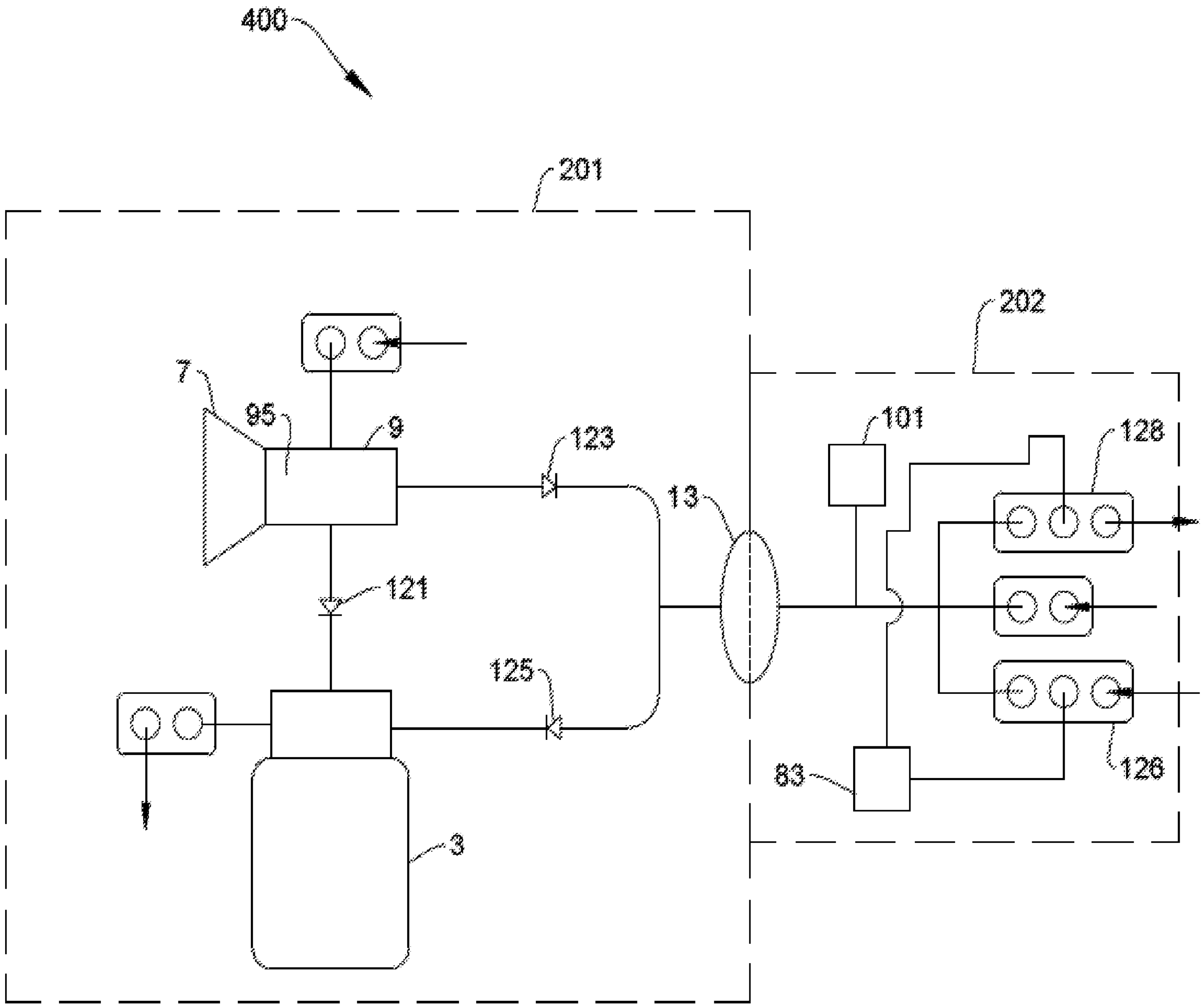
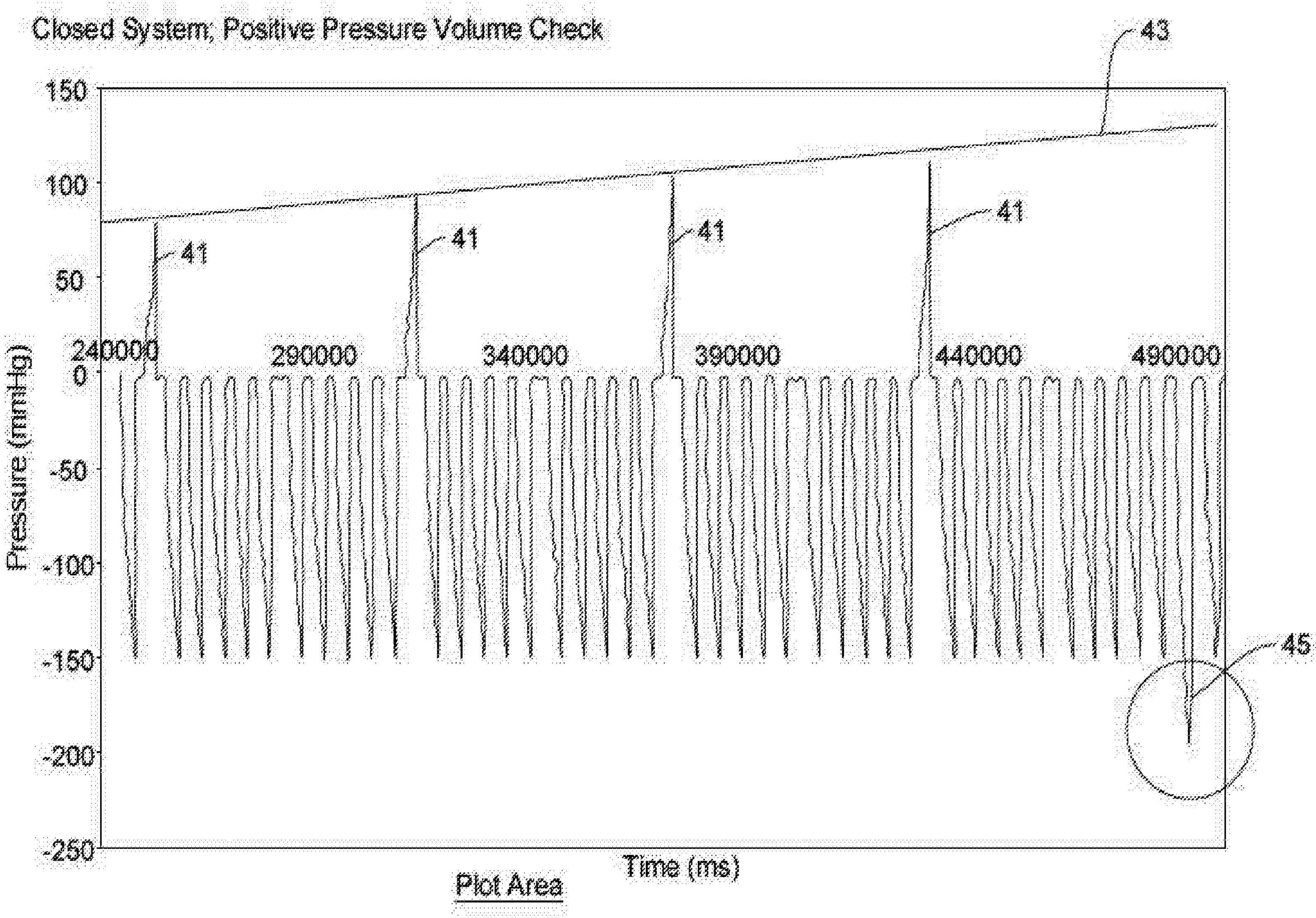
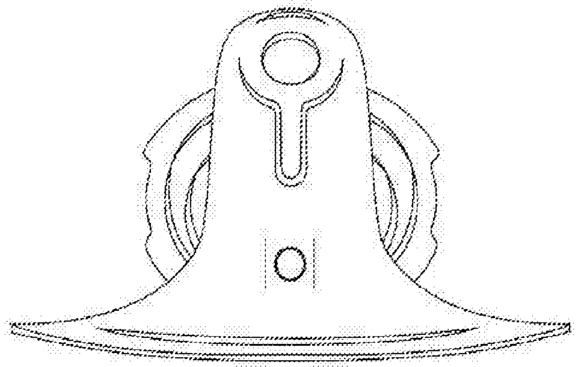


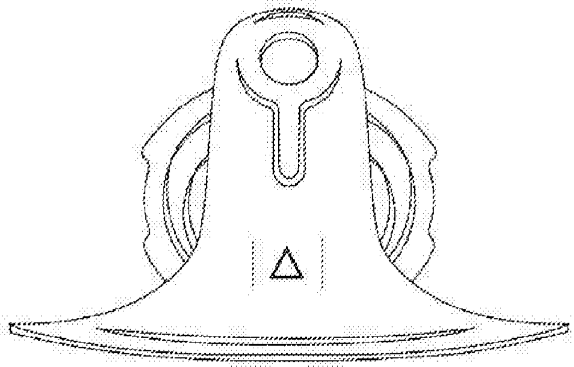
FIGURE 12

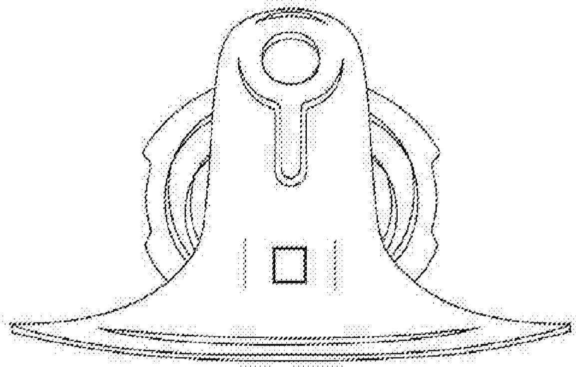


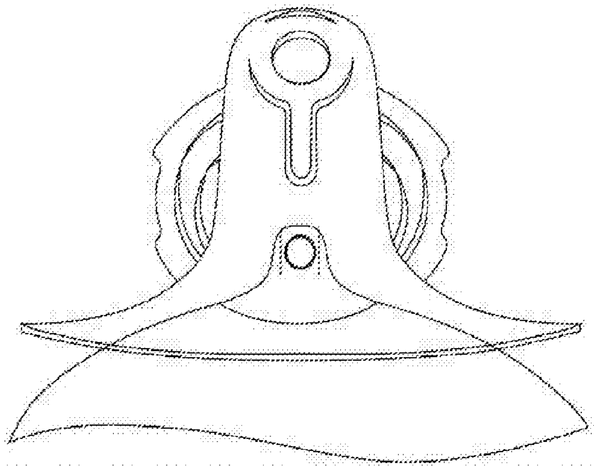
13/44

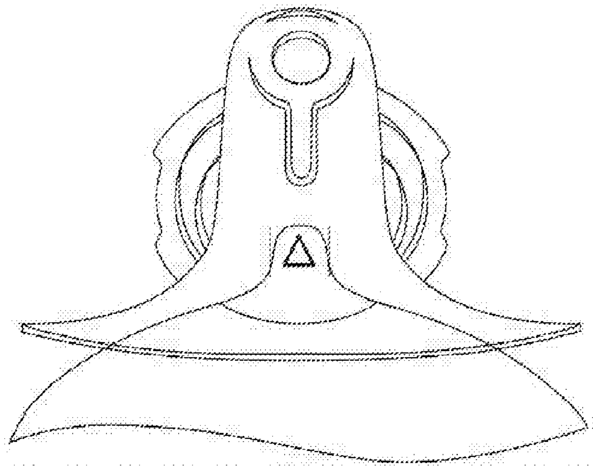
FIGURE 13


A1


B1


C1


A2


B2

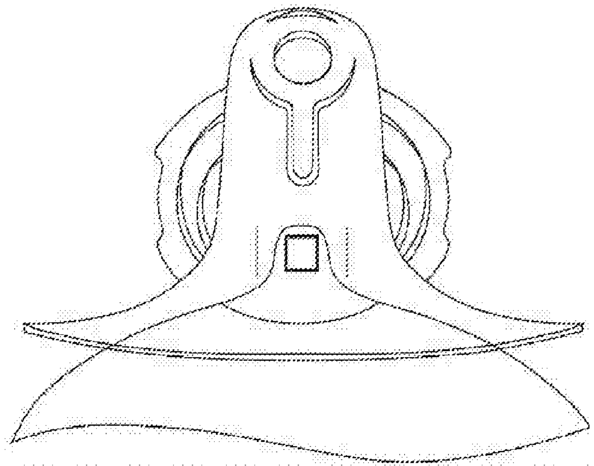

C2

FIGURE 14

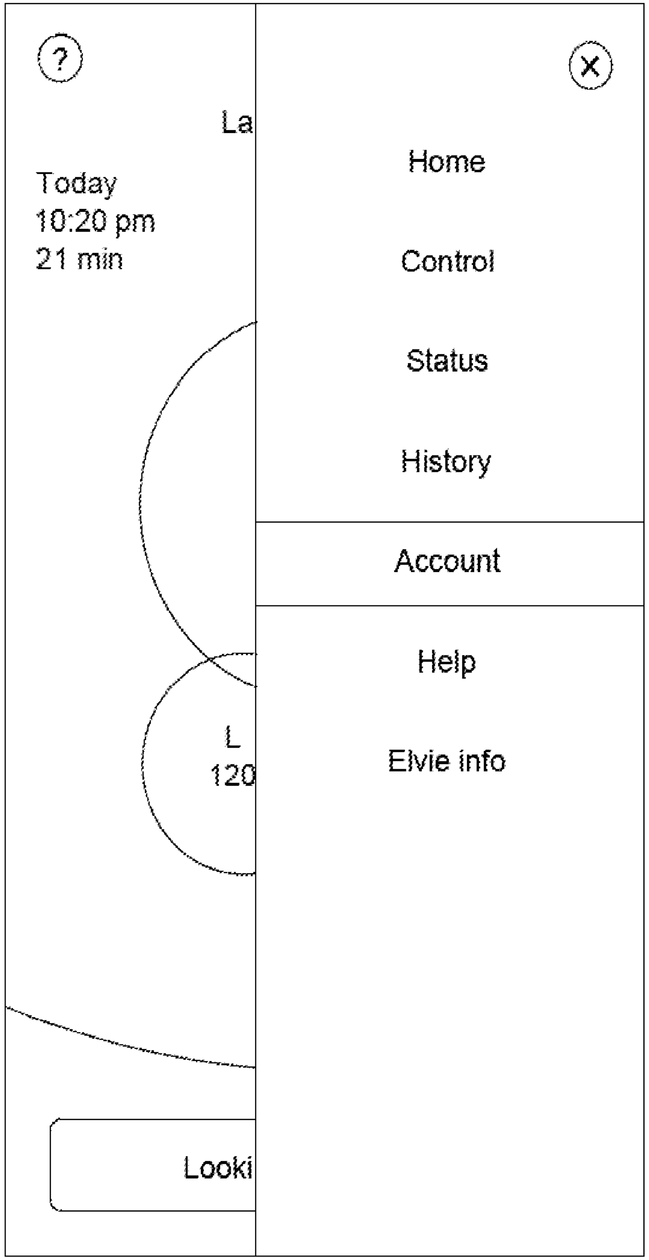

?
La
Today
10:20 pm
21 min
L
120
Looki
Home
Control
Status
History
Account
Help
Elvie info

FIGURE 15

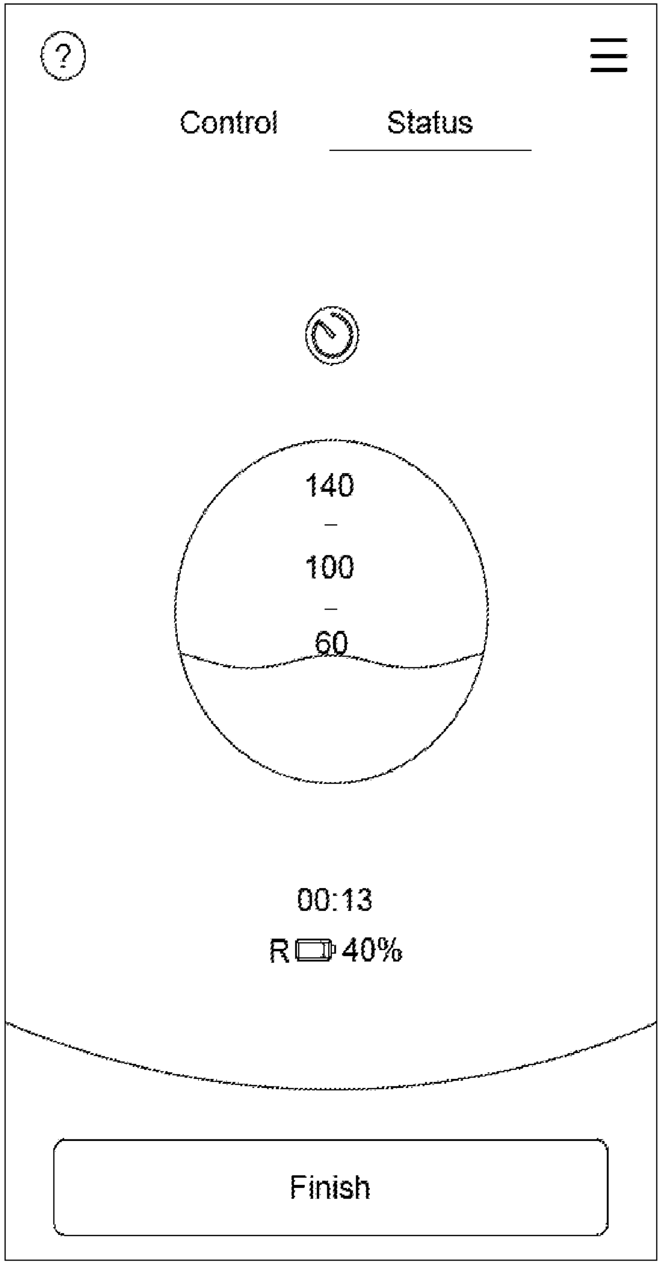


FIGURE 16

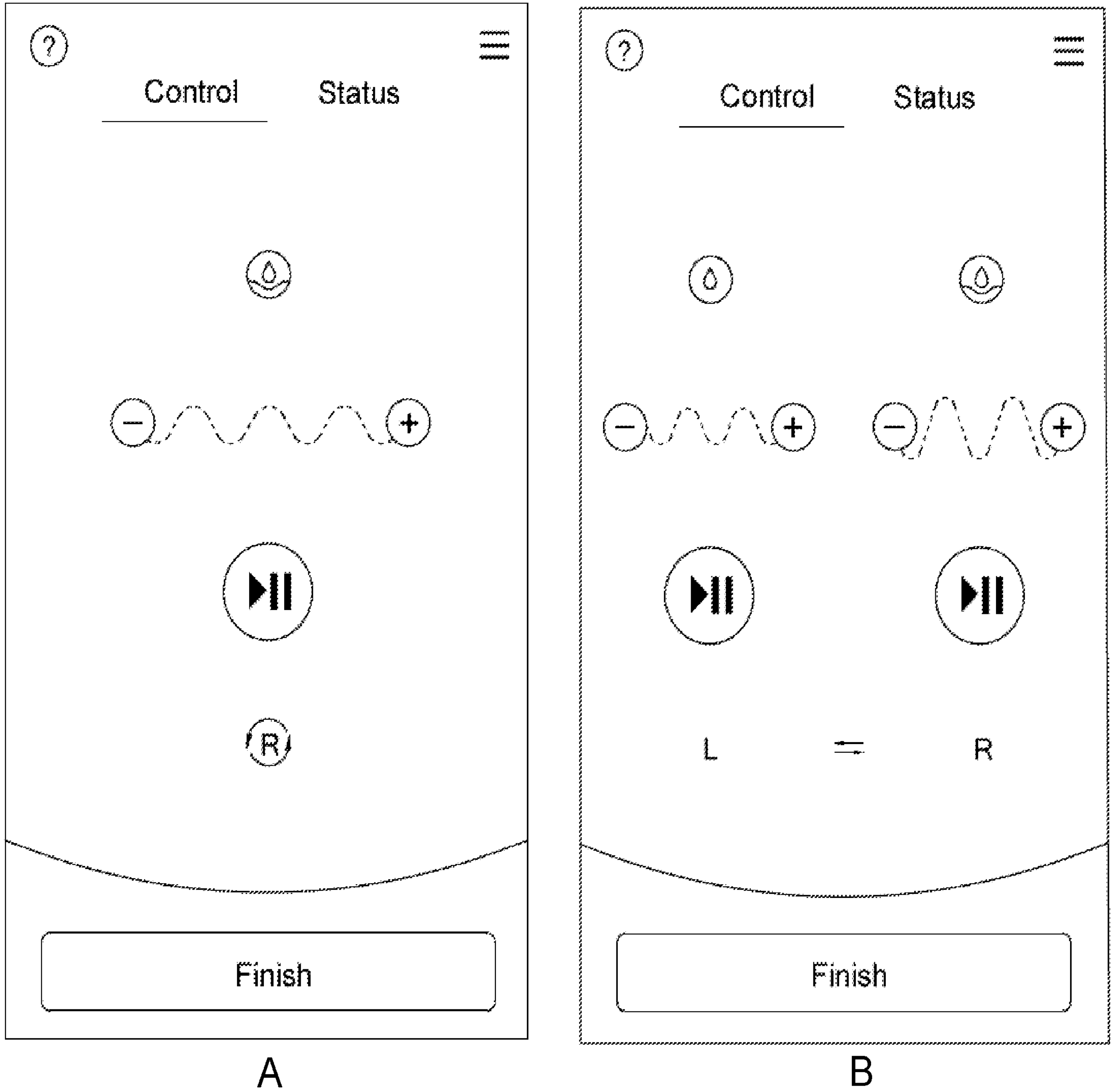


FIGURE 17

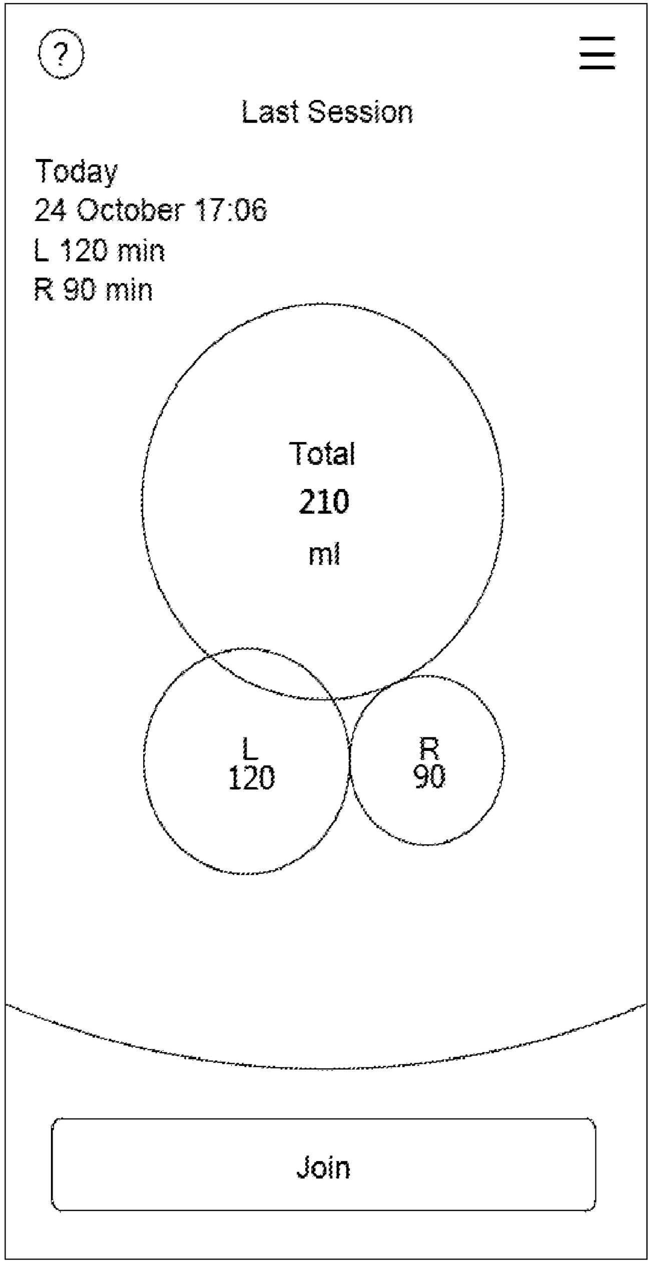

?
Last Session
Today
24 October 17:06
L 120 min
R 90 min
Total
210
ml
L
120
R
90
Join

FIGURE 18

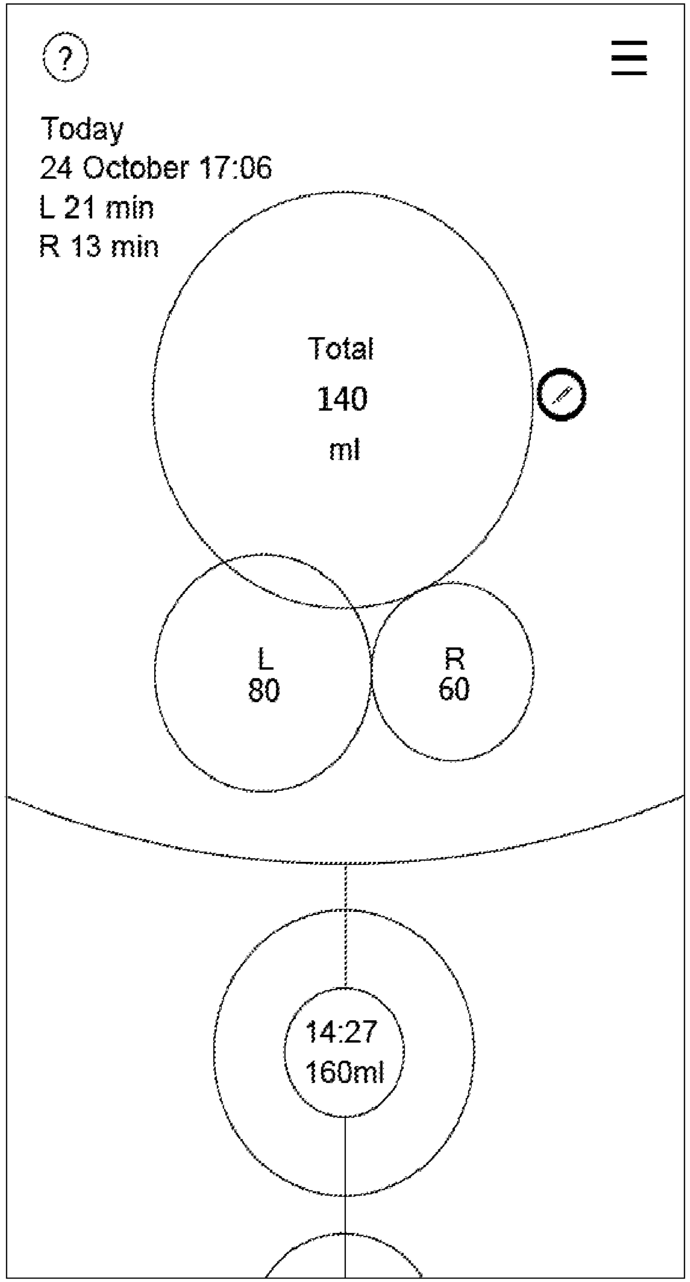

?
Today
24 October 17:06
L 21 min
R 13 min
Total
140
ml
L
80
R
60
14:27
160ml

FIGURE 19

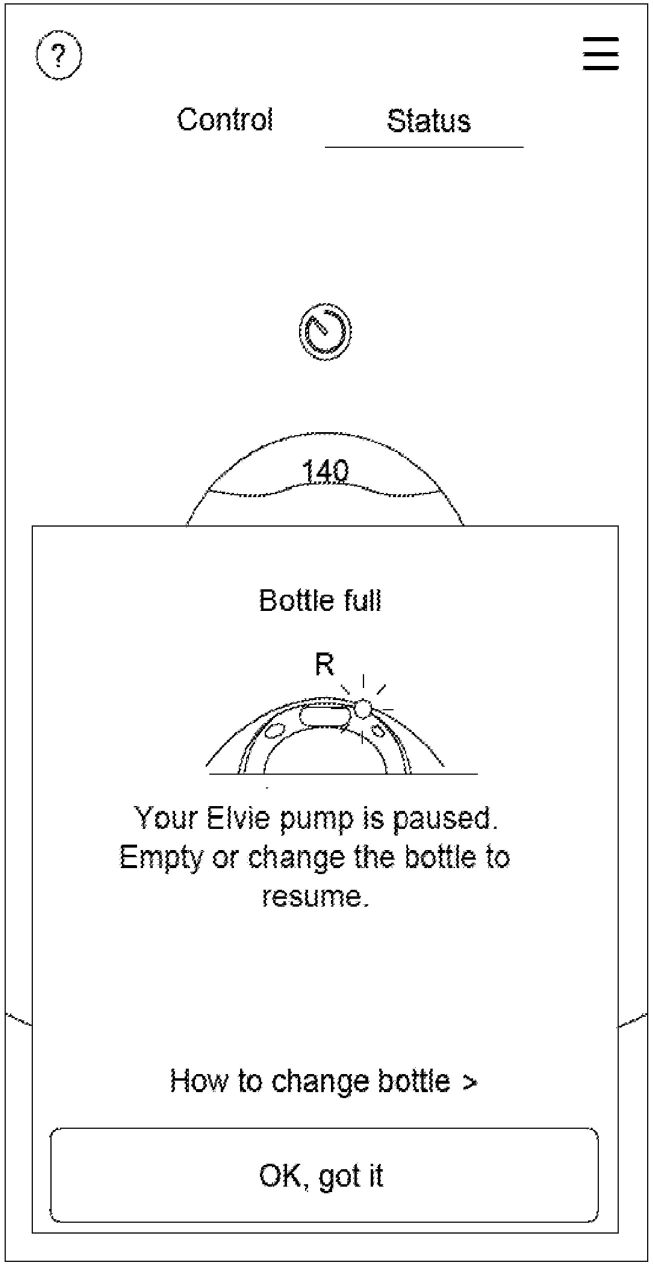
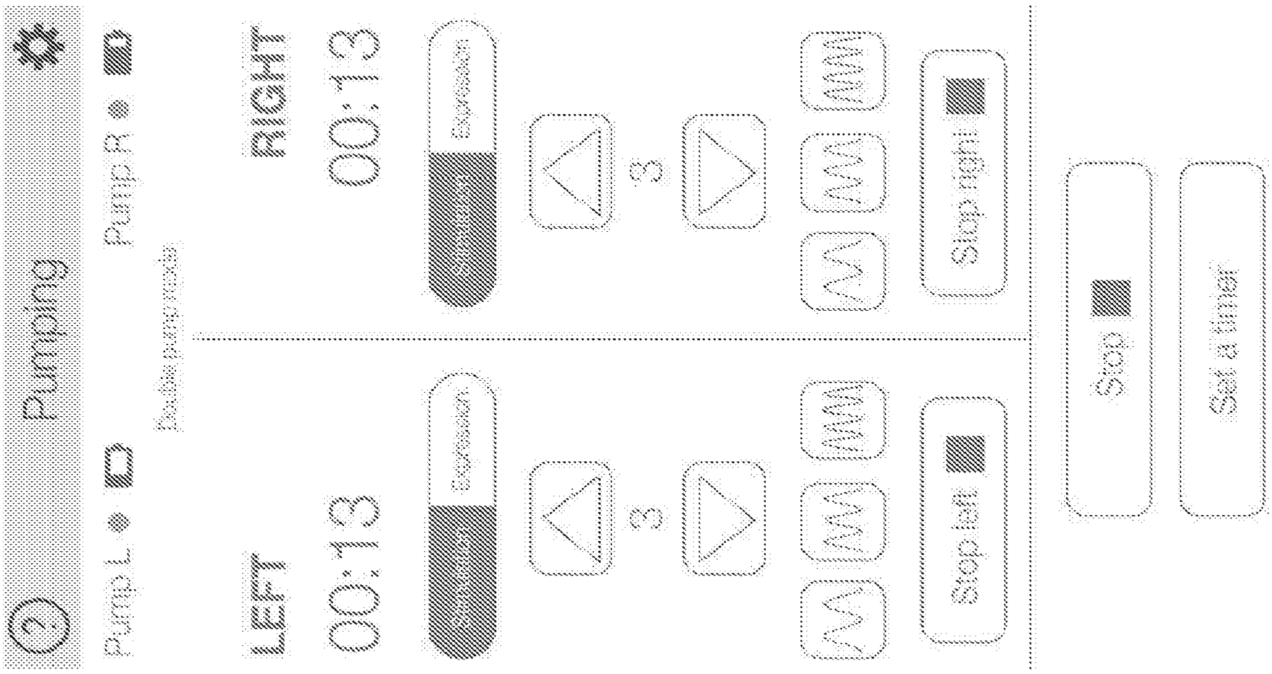

Control
Status
140
Bottle full
R
Your Elvie pump is paused. Empty or change the bottle to resume.
How to change bottle >
OK, got it

FIGURE 20



Pumping
Pump L
Pump R
Double pump mode
LEFT
RIGHT
00:13
00:13
Expression
Expression
3
3
Stop left
Stop right
Stop
Set a timer

FIGURE 21

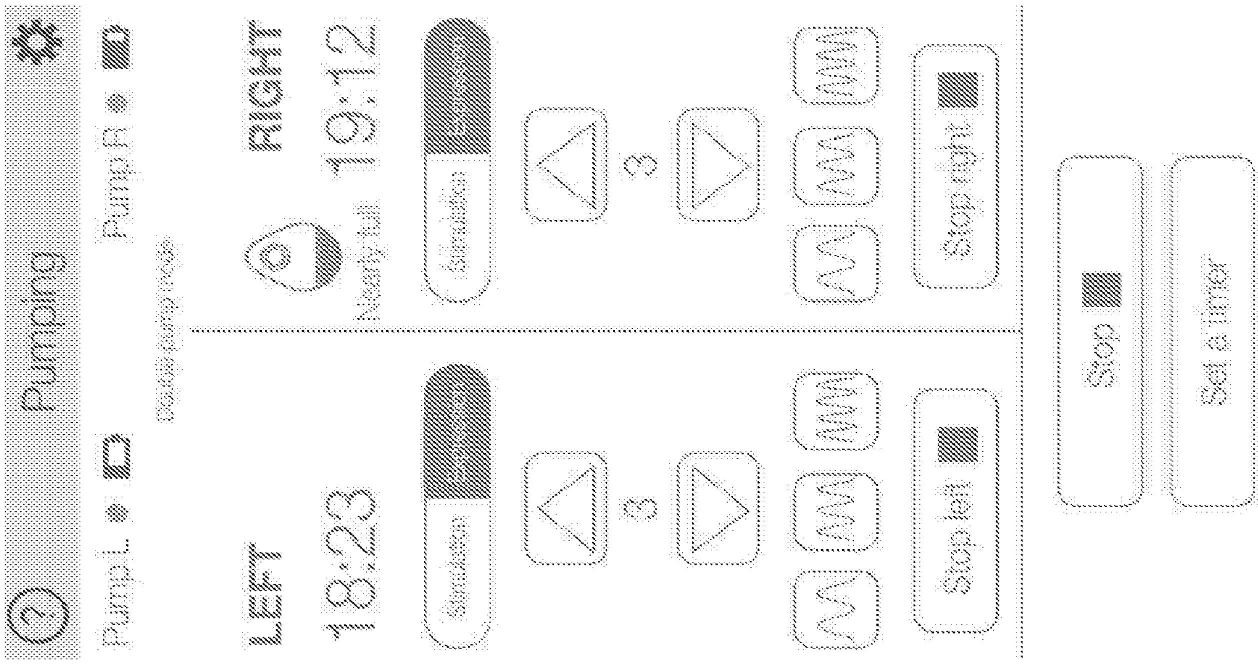
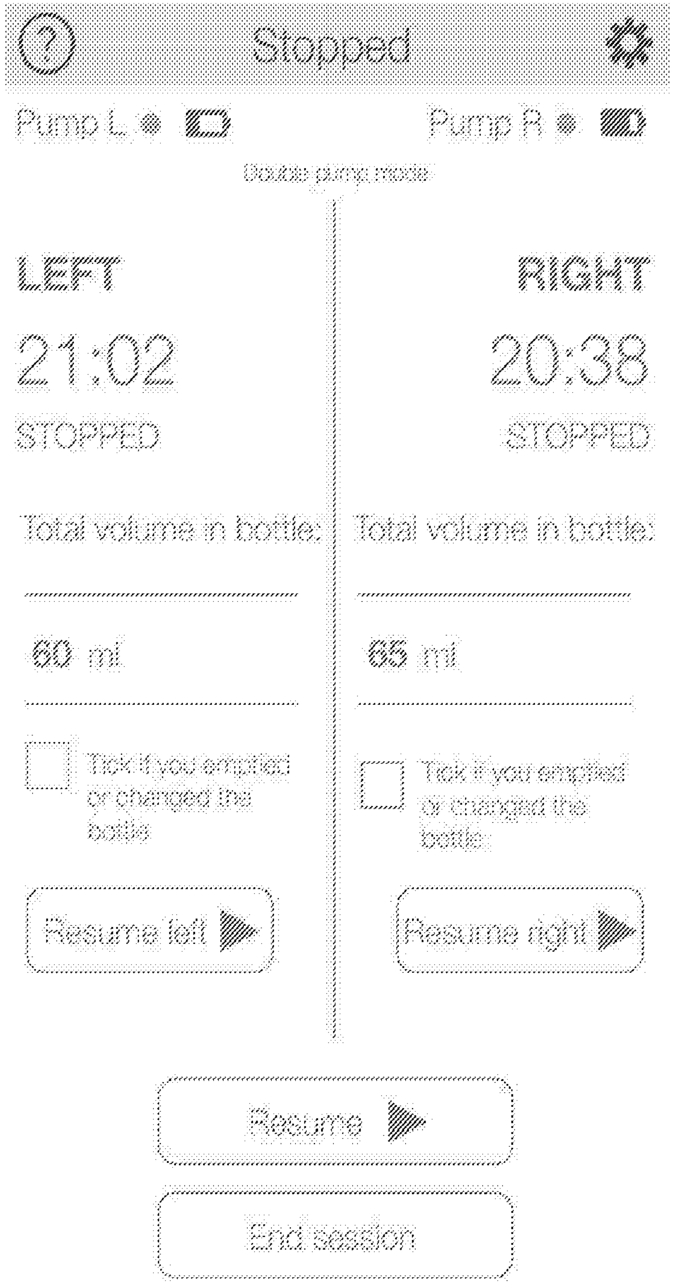

Pumping
Pump L
Pump R
Double pump mode
LEFT
18:23
RIGHT
19:12
Nearly full
Stimulation
Stimulation
3
3
Stop left
Stop right
Stop
Set a timer

FIGURE 22

FIGURE 23

23/44



24/44

FIGURE 24

25/44

FIGURE 25

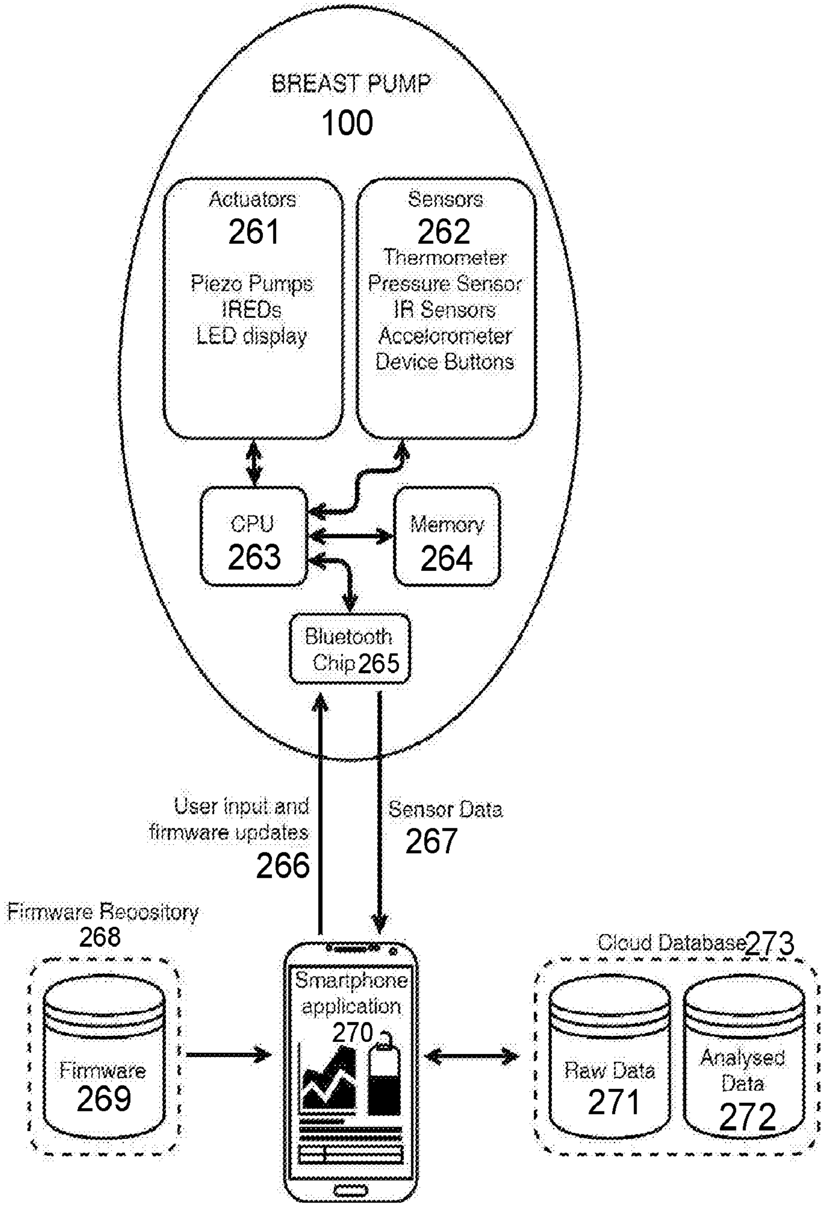

BREAST PUMP
100
Actuators
261
Piezo Pumps
IREDs
LED display
Sensors
262
Thermometer
Pressure Sensor
IR Sensors
Accelerometer
Device Buttons
CPU
263
Memory
264
Bluetooth
Chip 265
User input and
firmware updates
266
Sensor Data
267
Firmware Repository
268
Firmware
269
Smartphone
application
270
Cloud Database 273
Raw Data
271
Analysed
Data
272

FIGURE 26

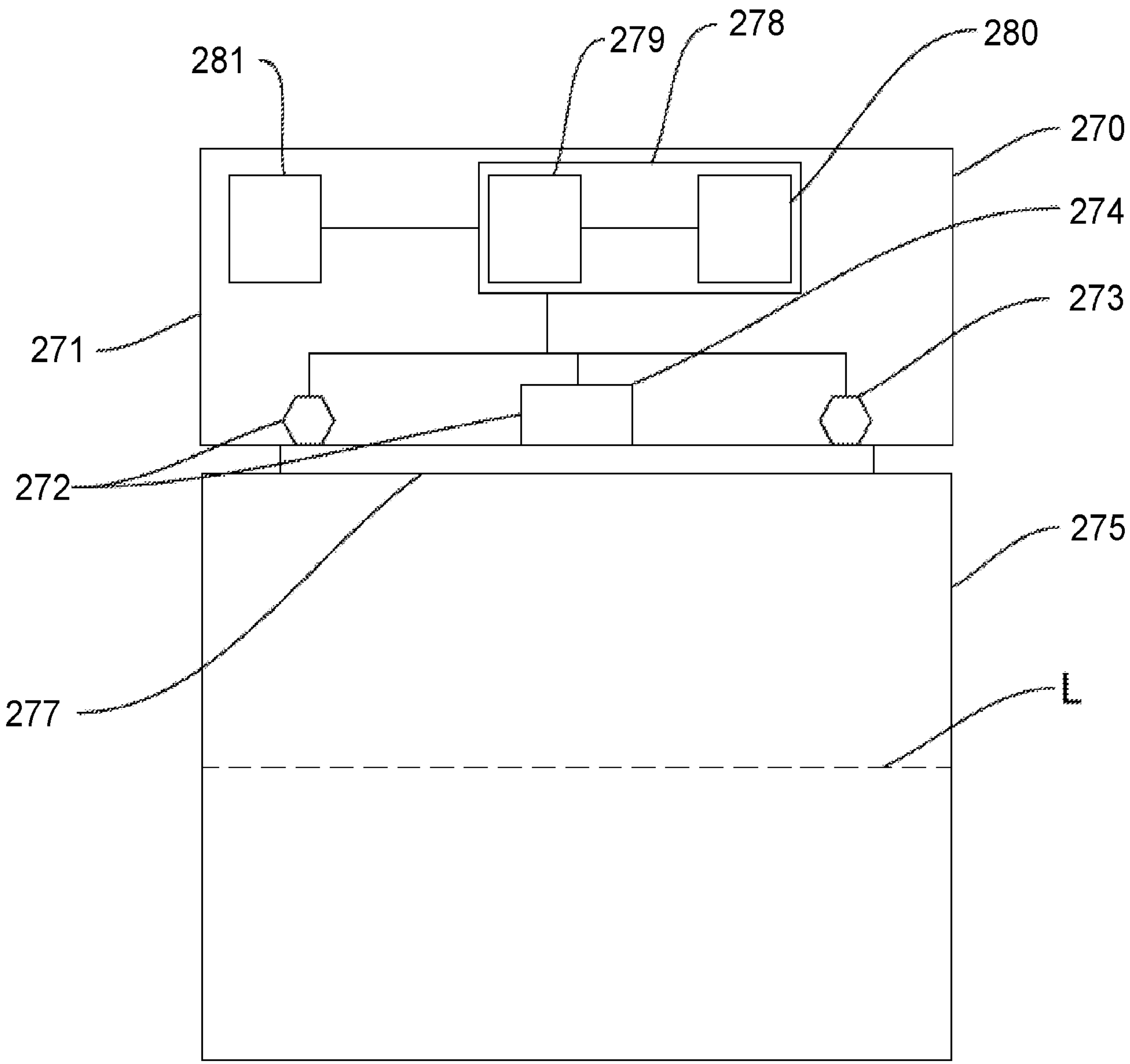


FIGURE 27

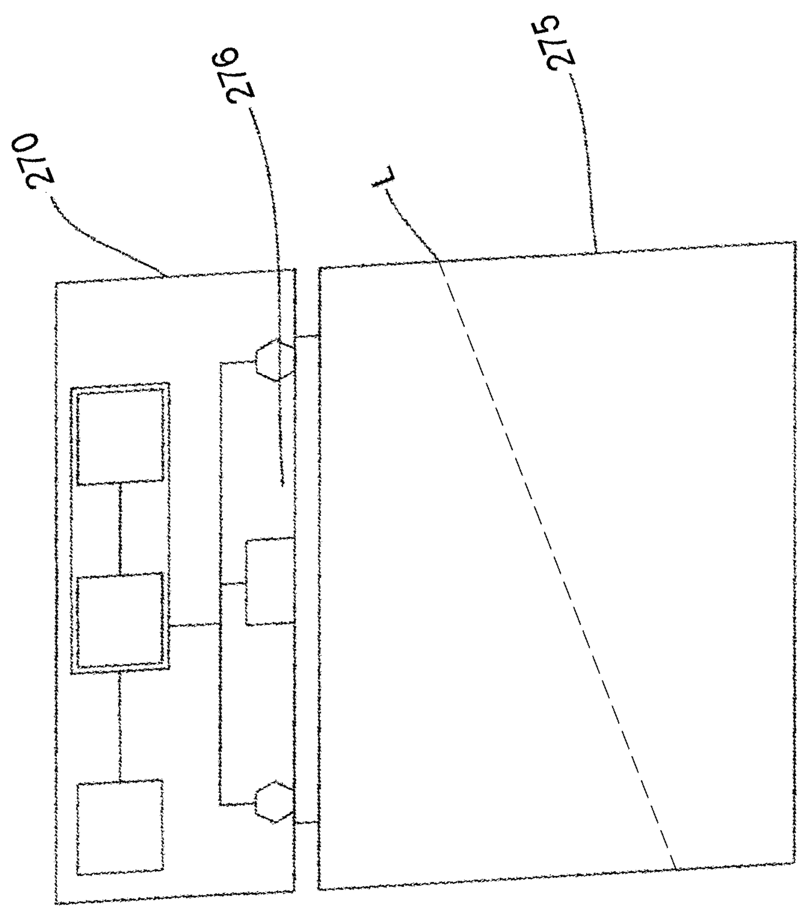


FIGURE 28

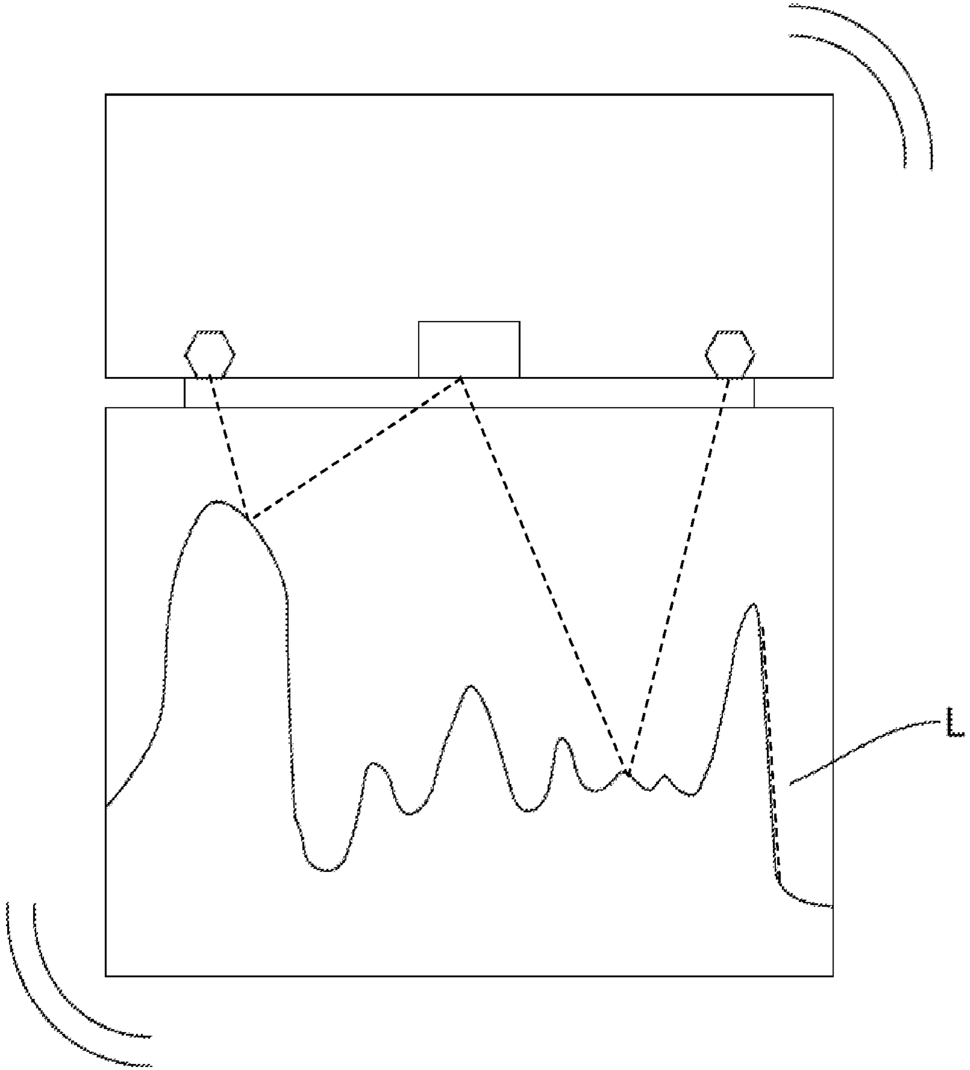


FIGURE 29

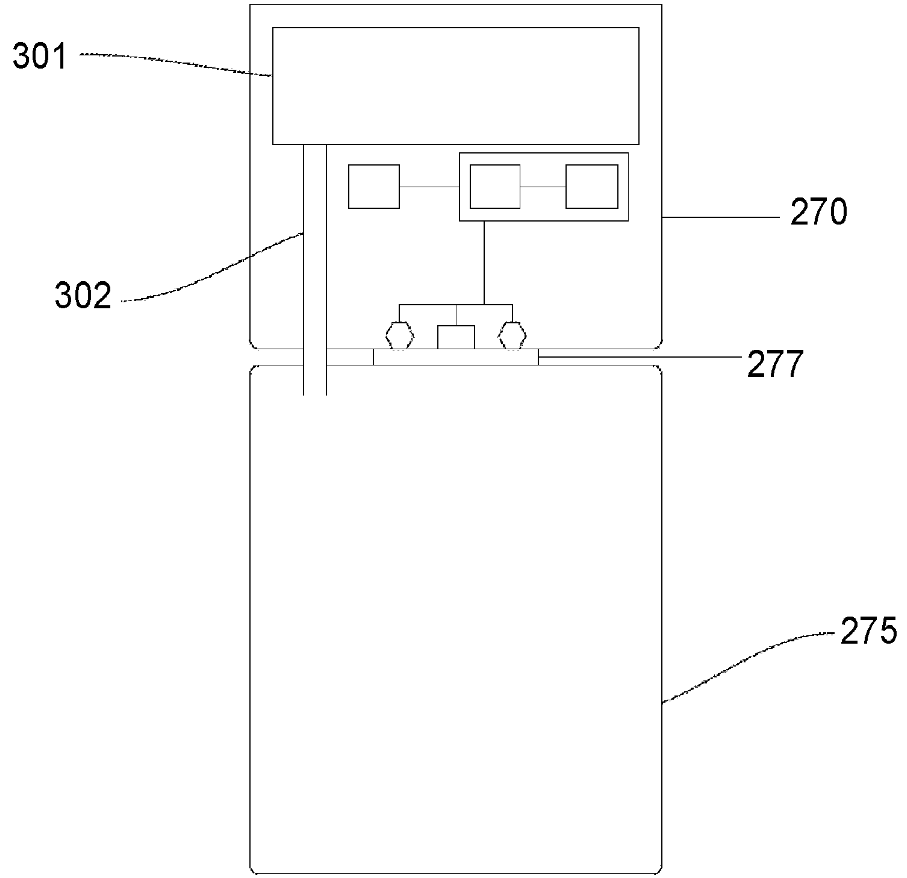


FIGURE 30

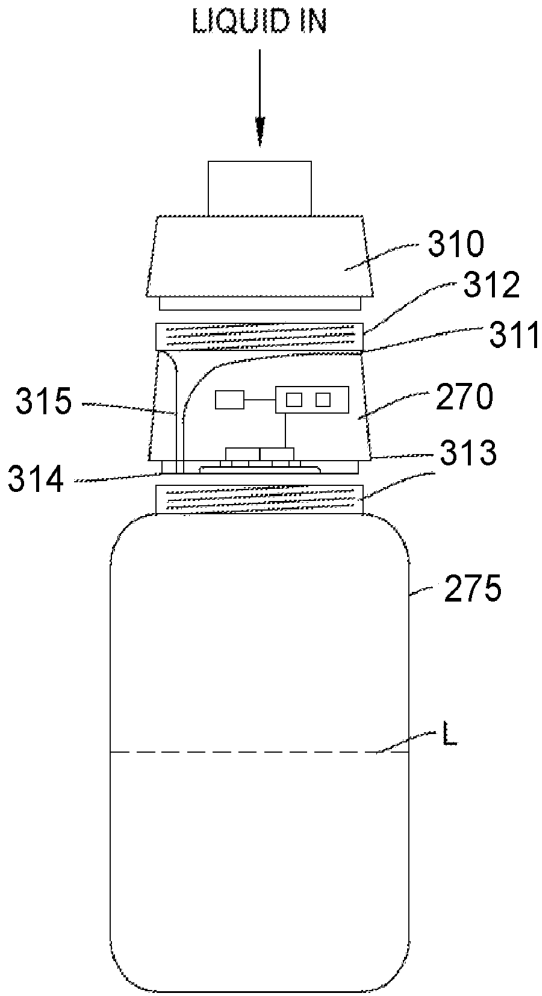


FIGURE 31

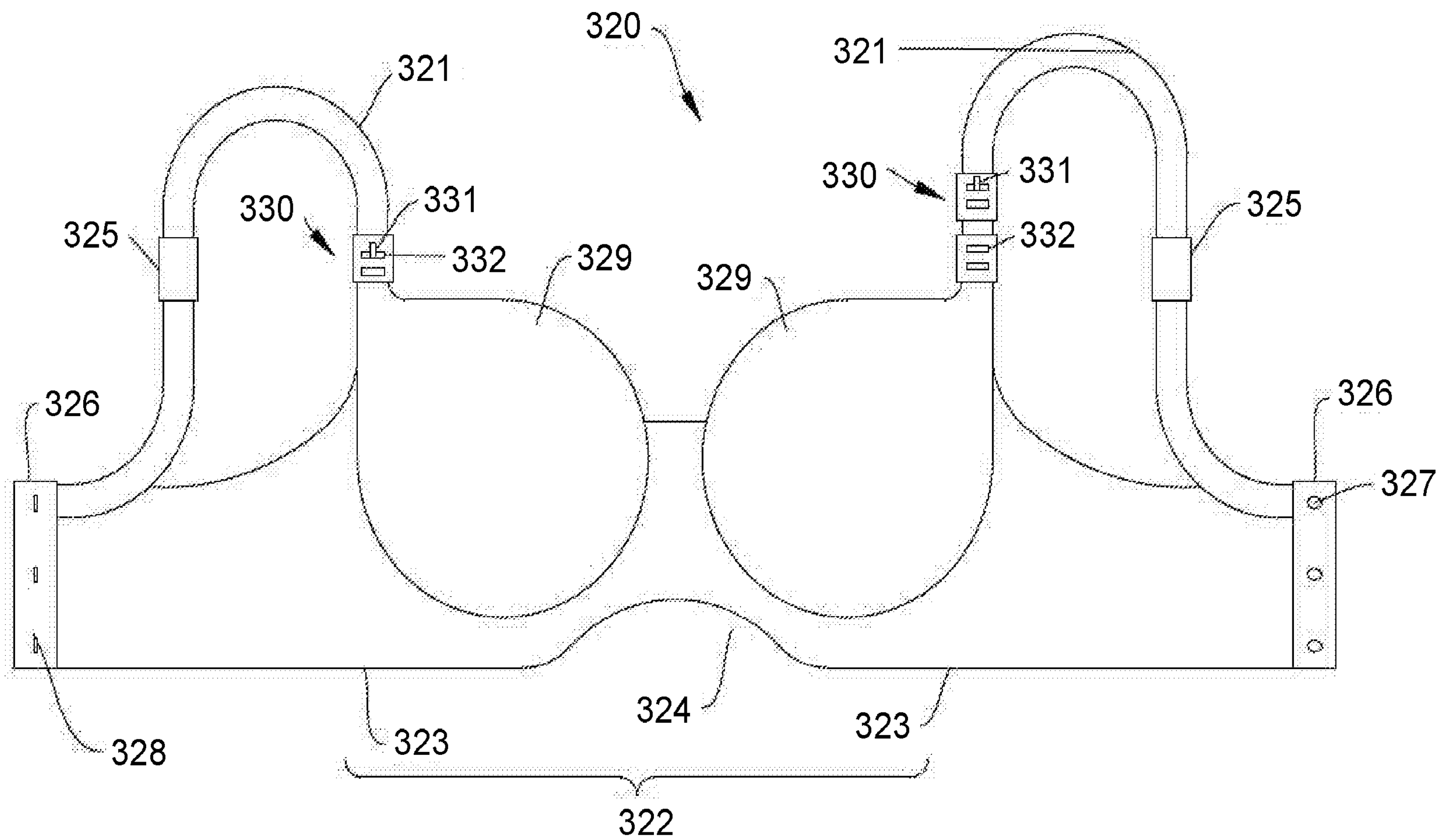
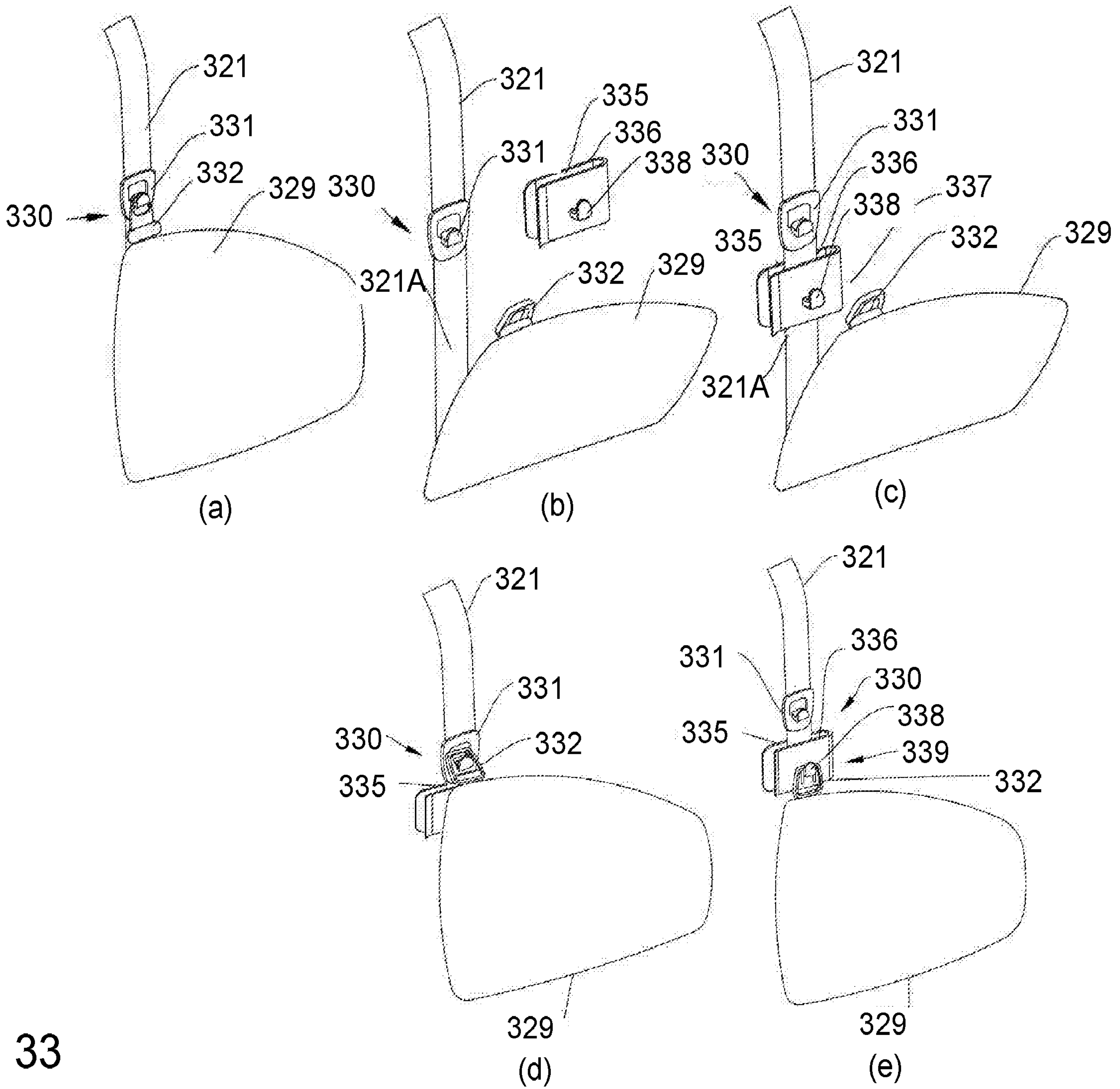

320
321
321
330
331
332
330
331
332
325
325
329
329
326
326
327
328
323
324
323
322

FIGURE 32



321
331
332
329
330
(a)
321
335
336
338
331
330
321A
332
329
(b)
321
331
336
337
338
330
335
332
329
321A
(c)
321
331
330
332
335
329
(d)
321
336
331
330
338
335
339
332
329
(e)

FIGURE 33

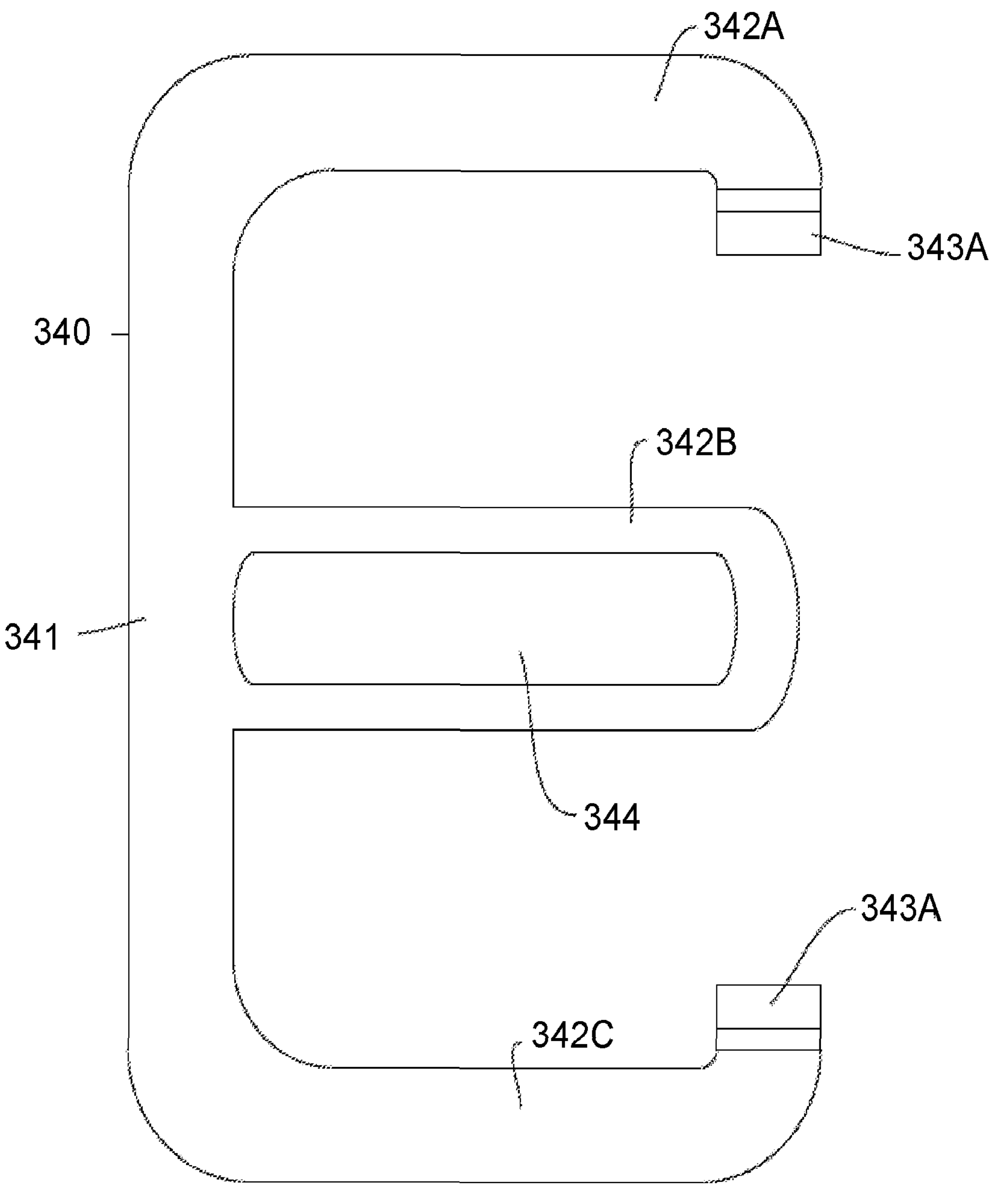


FIGURE 34

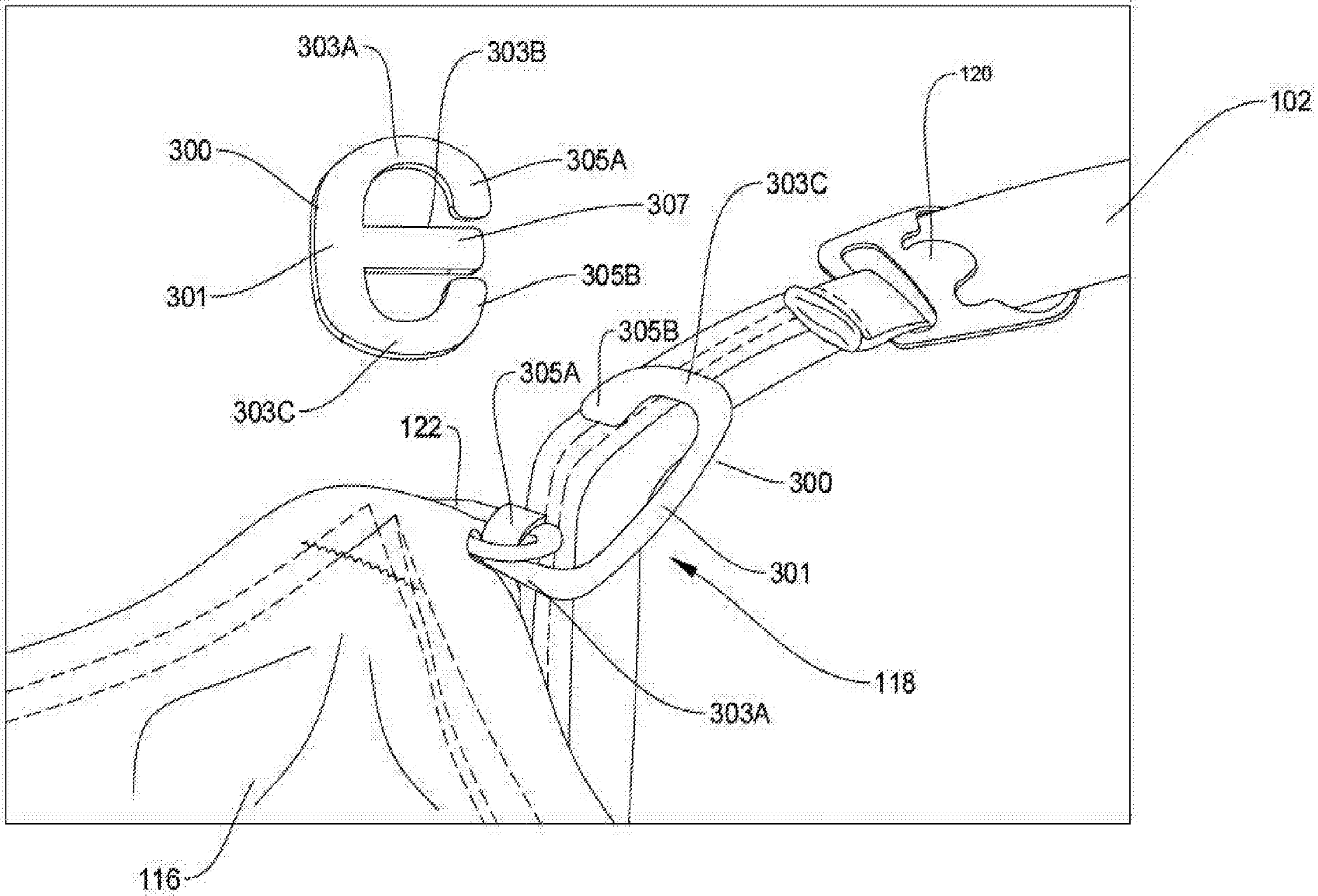

303A
303B
120
102
300
305A
307
303C
301
305B
305B
305A
303C
122
300
301
118
303A
116

FIGURE 35

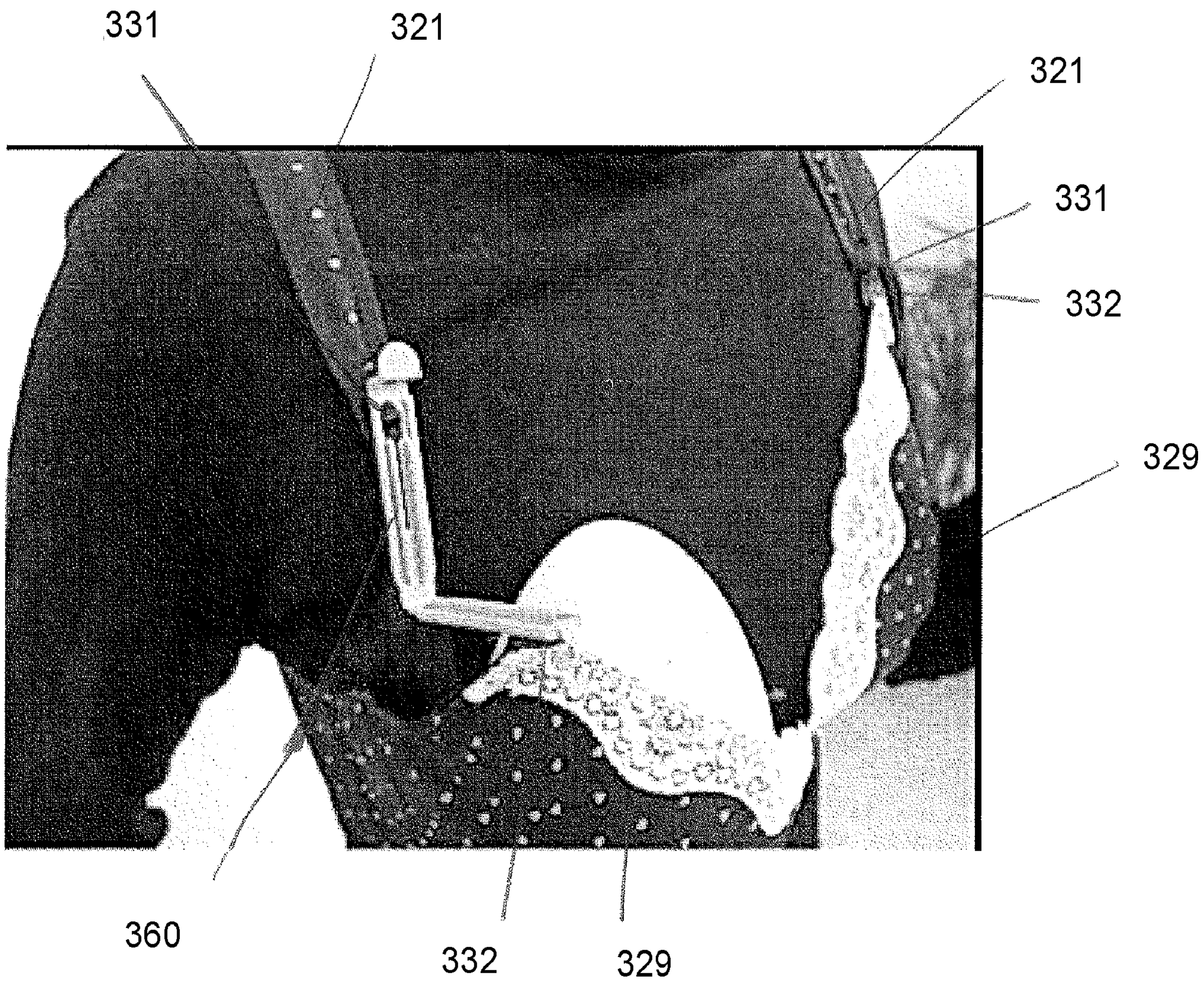


FIGURE 36

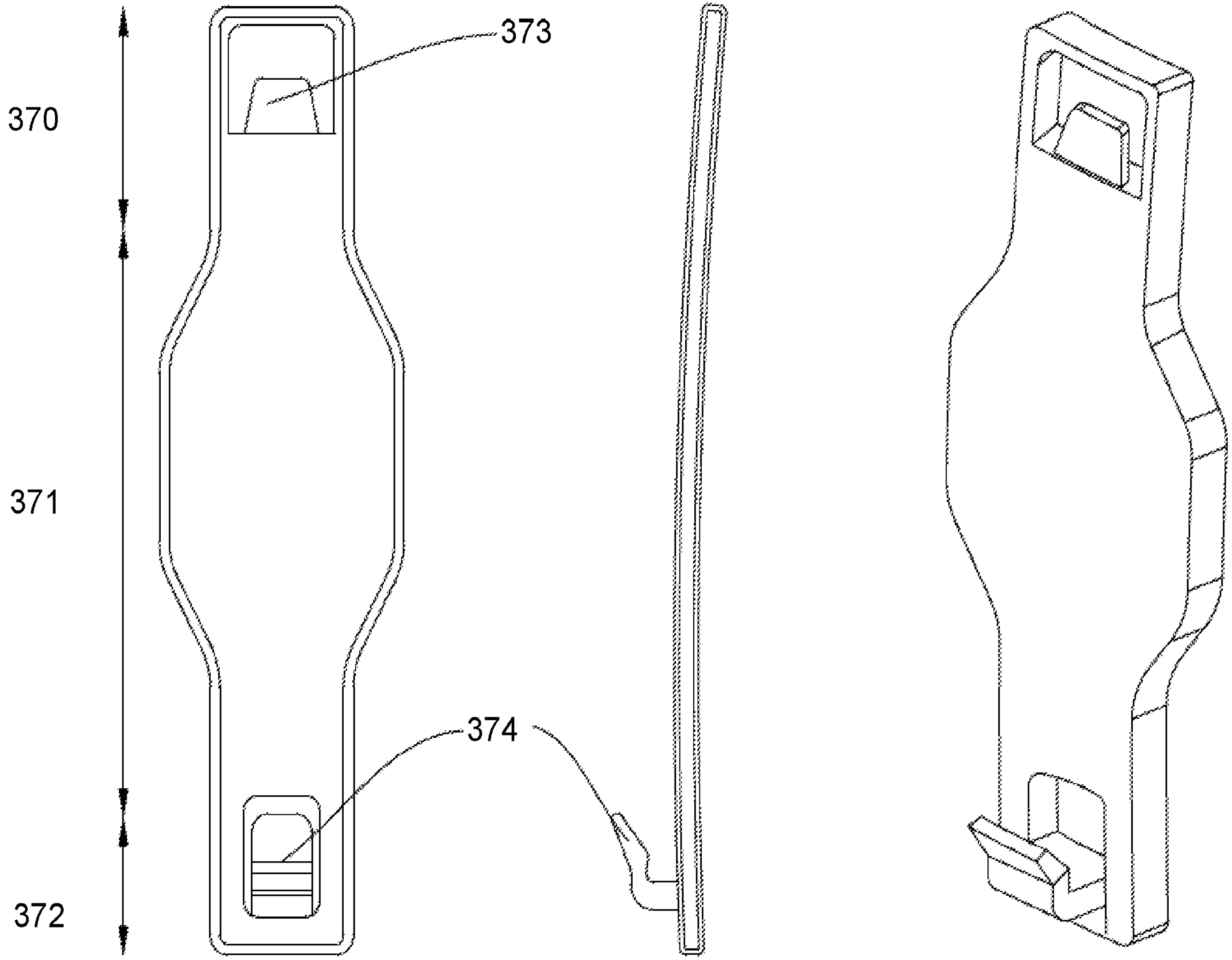


FIGURE 37

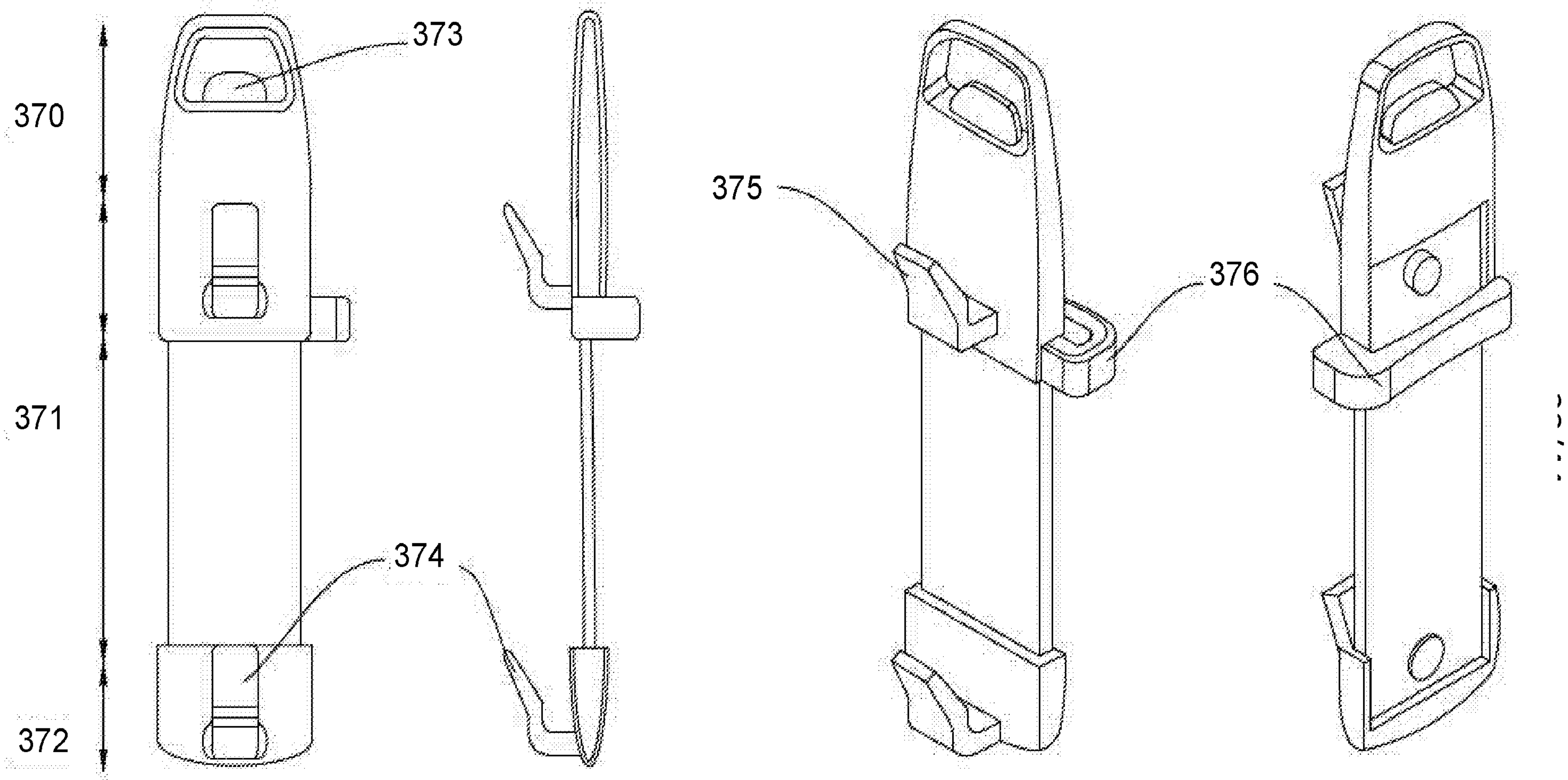


FIGURE 38

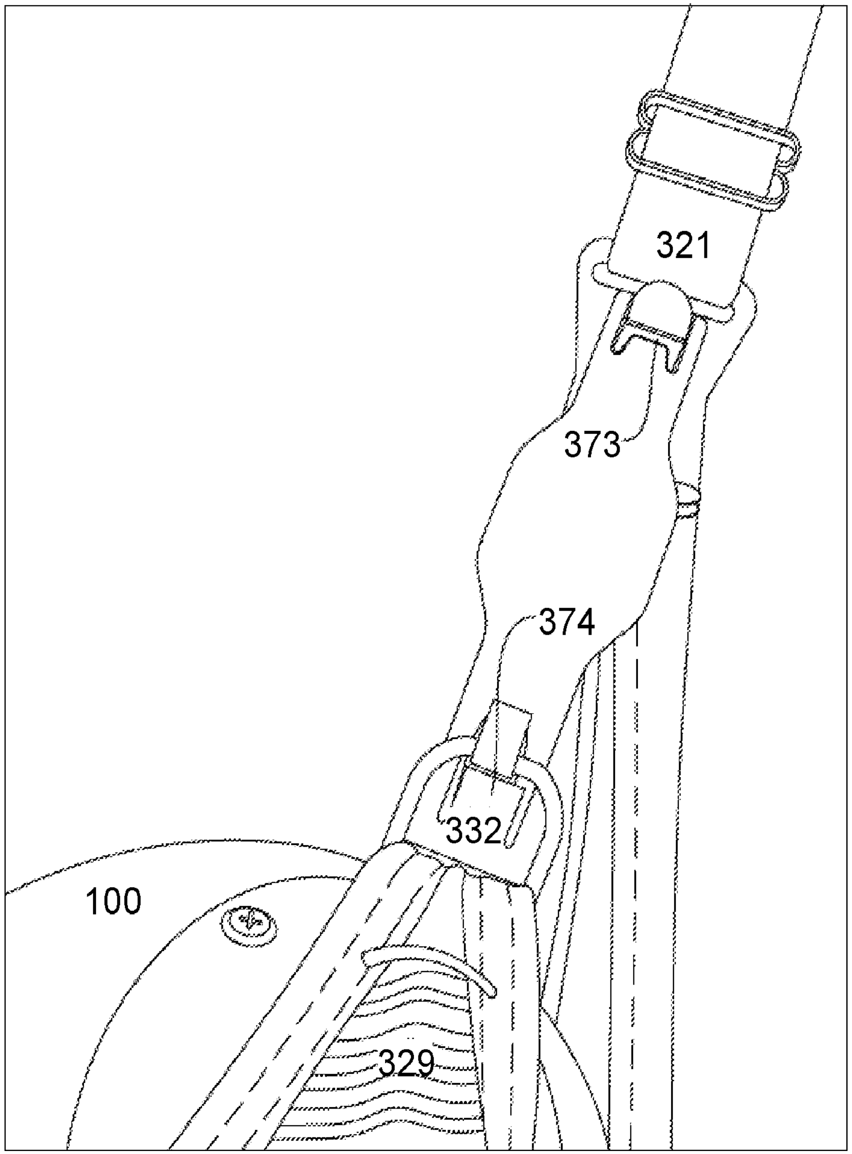


FIGURE 39

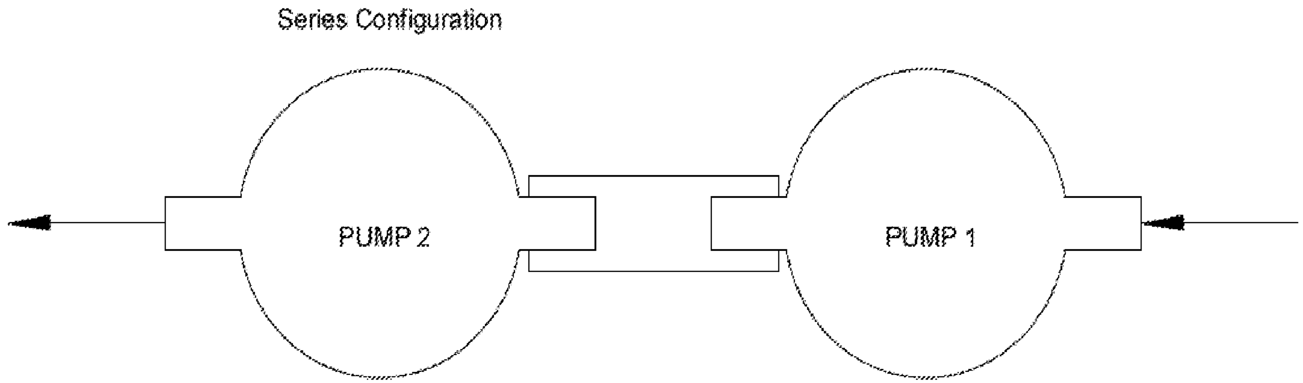


FIGURE 40

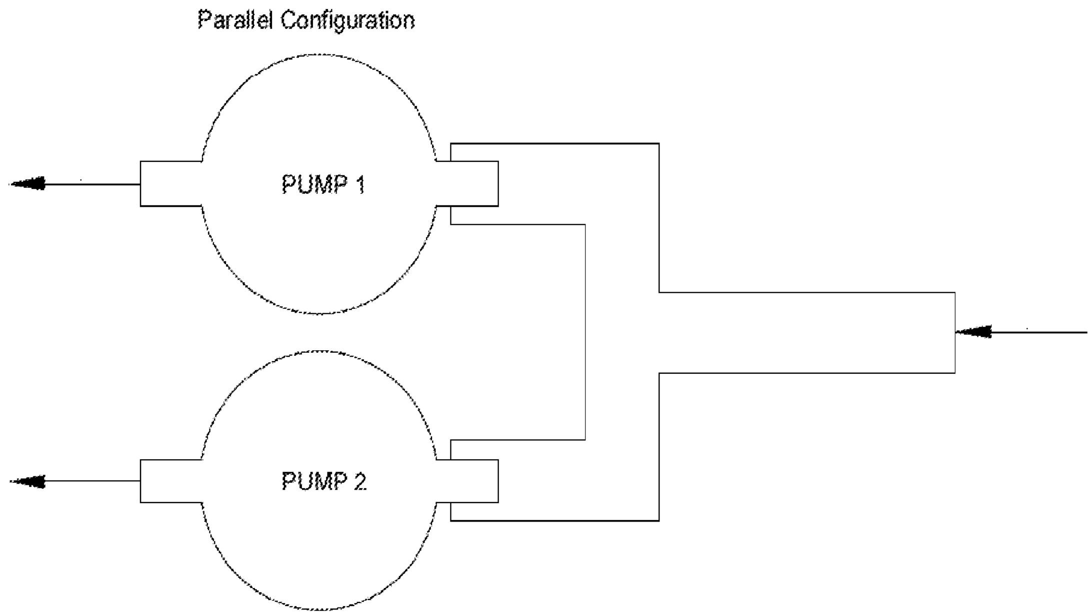


FIGURE 41

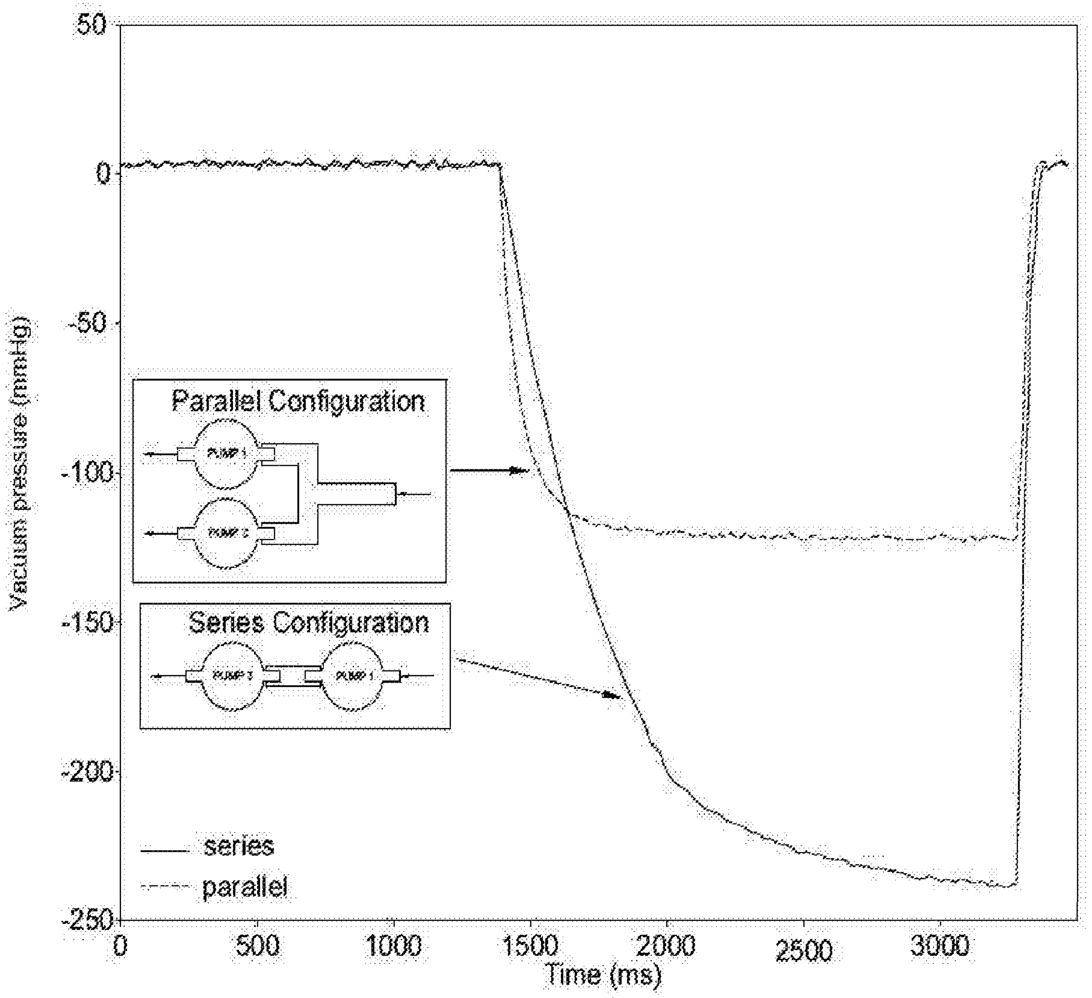

Parallel Configuration
Series Configuration
series
parallel
Vacuum pressure (mmHg)
Time (ms)
50
0
-50
-100
-150
-200
-250
0
500
1000
1500
2000
2500
3000

FIGURE 42

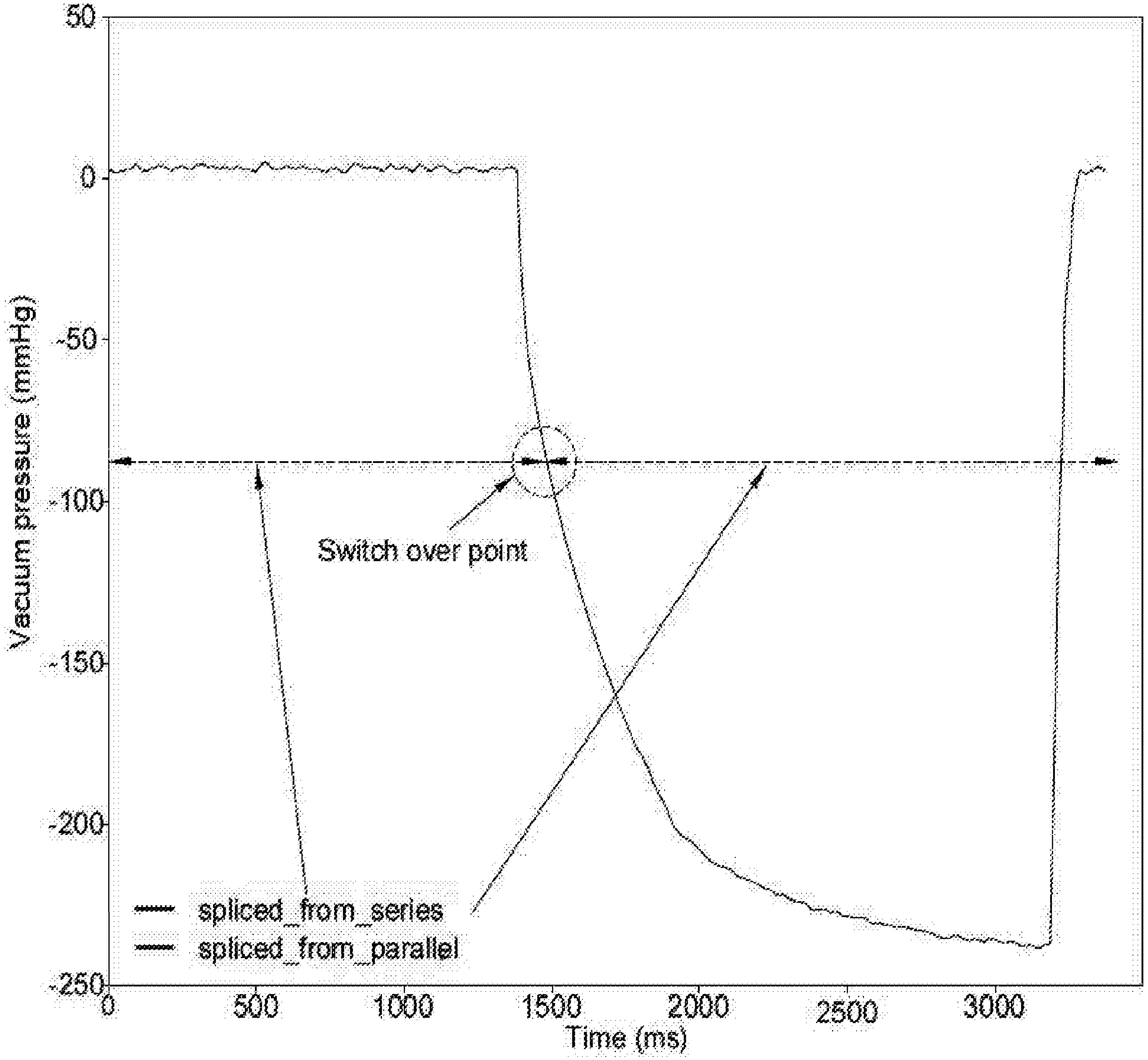

50
0
-50
-100
-150
-200
-250
Vacuum pressure (mmHg)
0
500
1000
1500
2000
2500
3000
Time (ms)
Switch over point
spliced_from_series
spliced_from_parallel

FIGURE 43

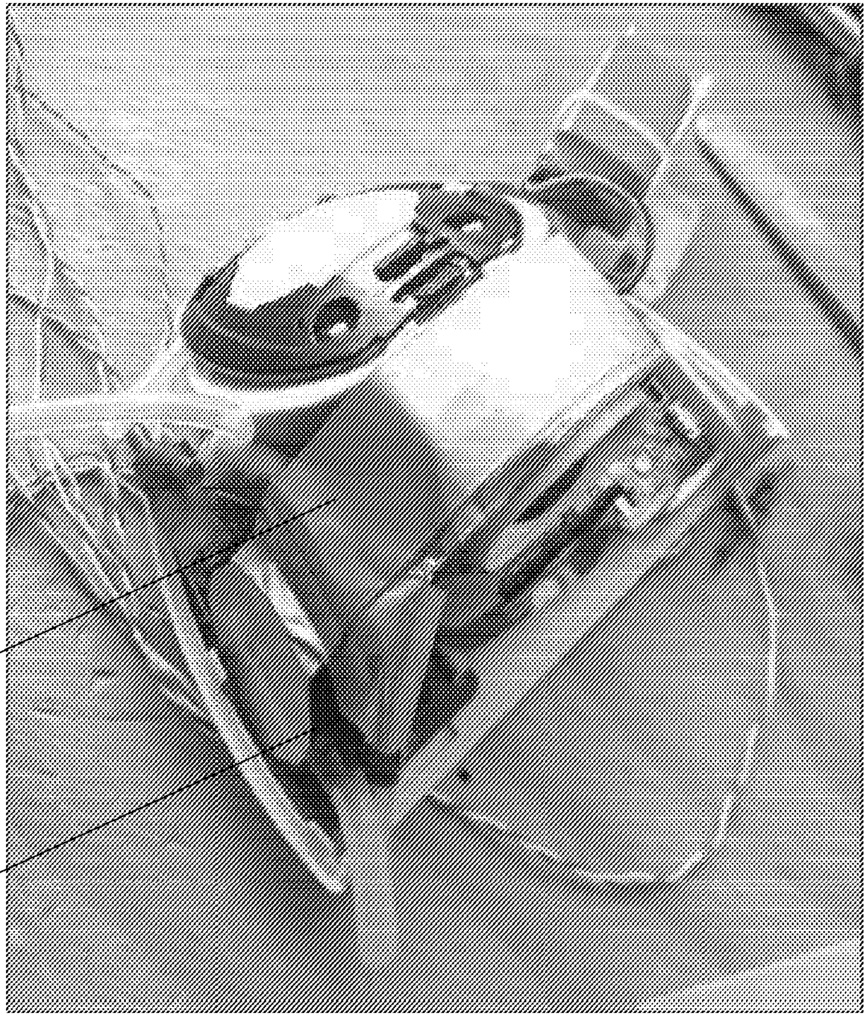


FIGURE 44

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	373499.00050	9649

78905 7590 05/20/2021
Saul Ewing Arnstein & Lehr LLP (Philadelphia)
Attn: Patent Docket Clerk
Centre Square West
1500 Market Street, 38th Floor
Philadelphia, PA 19102-2186

EXAMINER	
FREDRICKSON, COURTNEY B	

ART UNIT	PAPER NUMBER
3783	

NOTIFICATION DATE	DELIVERY MODE
05/20/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patents@saul.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 17/203,050	**Applicant(s)** O'TOOLE et al.	
	Examiner DIANE C GOODWYN	**Art Unit** OPET	**AIA (FITF) Status** Yes

1. THE REQUEST FILED 16 March 2021 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).

B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to DIANE GOODWYN at (571) 272-6735. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/DIANE C GOODWYN/
Paralegal Specialist, OPET

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	373499.00050	9649

78905 7590 06/24/2021
Saul Ewing Arnstein & Lehr LLP (Philadelphia)
Attn: Patent Docket Clerk
Centre Square West
1500 Market Street, 38th Floor
Philadelphia, PA 19102-2186

EXAMINER	
FREDRICKSON, COURTNEY B	

ART UNIT	PAPER NUMBER
3783	

NOTIFICATION DATE	DELIVERY MODE
06/24/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patents@saul.com

Office Action Summary	Application No. 17/203,050	Applicant(s) O'TOOLE et al.	
	Examiner COURTNEY FREDRICKSON	Art Unit 3783	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 16March2021.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-30 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6) ☐ Claim(s) _____ is/are allowed.
7) ☑ Claim(s) 1-30 is/are rejected.
8) ☐ Claim(s) _____ is/are objected to.
9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 16March2021 is/are: a)☑ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a)☑ All b)☐ Some** c)☐ None of the:
1.☑ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)
2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date ______.
3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date ______.
4) ☐ Other: ______.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Information Disclosure Statement

The information disclosure statement (IDS) submitted is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Objections

Claims 8, 17, and 18 are objected to because of the following informalities:

Claim 8 should be amended to recite "piece item that, in use, presents…" to correct for grammar.

Claim 17 should be amended to recite "…pressure caused by the [[air]] pump" in line 4 to keep claim language consistent.

Claim 18 should be amended to recite "…the nipple tunnel [[portion]]" in line 2 to keep claim language consistent.

Appropriate correction is required.

Claim Interpretation

The following is a quotation of 35 U.S.C. 112(f):

> (f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The claims in this application are given their broadest reasonable interpretation using the plain meaning of the claim language in light of the specification as it would be understood by one of ordinary skill in the art. The broadest reasonable interpretation of a claim element (also commonly referred to as a claim limitation) is limited by the description in the specification when 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is invoked.

As explained in MPEP § 2181, subsection I, claim limitations that meet the following three-prong test will be interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph:

(A) the claim limitation uses the term “means” or “step” or a term used as a substitute for “means” that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function;

(B) the term “means” or “step” or the generic placeholder is modified by functional language, typically, but not always linked by the transition word “for” (e.g., “means for”) or another linking word or phrase, such as “configured to” or “so that”; and

(C) the term “means” or “step” or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Use of the word “means” (or “step”) in a claim with functional language creates a rebuttable presumption that the claim limitation is to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites sufficient structure, material, or acts to entirely perform the recited function.

Absence of the word “means” (or “step”) in a claim creates a rebuttable presumption that the claim limitation is not to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is not interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites function without reciting sufficient structure, material or acts to entirely perform the recited function.

Claim limitations in this application that use the word “means” (or “step”) are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action. Conversely, claim limitations in this application that do not use the word “means” (or “step”) are not being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action.

This application includes one or more claim limitations that do not use the word “means,” but are nonetheless being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because the claim limitation(s) uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier.

Such claim limitation(s) is/are: "**mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action**" in **claim 19**. The examiner note that this limitation will be interpreted to mean "a mechanical or magnetic mechanism" as set forth on pg. 105, lines 1-2, and functional equivalents thereof.

Because this/these claim limitation(s) is/are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, it/they is/are being interpreted to cover the corresponding structure described in the specification as performing the claimed function, and equivalents thereof.

If applicant does not intend to have this/these limitation(s) interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation(s) recite(s) sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3, 7, 8, 11, 12, 16-18, 25, and 30 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly

point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

Claim 3 recites the limitation "the base" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 7 recites the limitation "the breast" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim 8 recites the limitation "the nipple" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 11 recites the limitation "the top" and “the bottom” in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 12 recites the limitation "the diaphragm" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 16 recites the limitation "the diaphragm" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 17 recites the limitation "the diaphragm", “the recess”, and “the rear surface” in lines 1 and 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 18 recites the limitation "the diaphragm" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 25 recites the limitation "the top” in line 2 and “the base” in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim 30 recites the limitation "the quantity" in line 3, “the height” in line 3, and “the liquid” in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 3, 8-11, 15, 16, 18, 21-24, and 26-28 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil (US 20130023821) in view of Makower (US

20170072118) in further view of Yodfat (US 20110009824) and in further view of Myers (US 20080275386).

Regarding claim 1, Khalil discloses a breast pump device that is configured as a self-contained, in-bra wearable device (the device of fig. 9 is shown to be a self-contained device which is capable of being worn in a bra; paragraph 32) and that includes:

a housing (shell ring and cover 6' and 6" in fig. 9 form a housing) that includes a power source (paragraph 51 discloses a power source can be integrated into the housing); control electronics ("control system" in paragraph 68); an air pump generating negative air pressure (vacuum pump 81 in fig. 10);

(ii) a breast shield (breast interface 1 in fig. 7) made up of a breast flange (base part 12 in fig. 7) and a nipple tunnel (stub 10 in fig. fig. 4);

(iii) a milk container that is configured to attach to and removed from the housing (milk collection container 7' in fig. 9; paragraph 69 discloses the attachment being releasable).

However, Khalil does not teach the power source being a rechargeable battery and a power charging circuit for controlling the charging of the rechargeable battery; control electronics and pump powered by the rechargeable battery, the pump generating a maximum suction of approximately 240mmHg.

Makower is directed towards a substantially similar breast pump device (fig. 1b) which has a housing (main body 34 in fig. 1a) that includes a battery (battery 48 in fig. 14a) capable of being recharged (paragraph 151 teaches that the battery can be recharged) and operable to power the control electronics (controller 52 in fig. 14a;

paragraph 12 teaches the battery is electrically connected to the controller) and the pump (drivers 46 and 44 in fig. 14a; paragraph 12 teaches the battery is electrically connected to the pump).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the power source of Khalil to be a rechargeable battery which powers the control electronics and pump, as taught by Makower. The modification of the rechargeable battery coupled to the pump and control electronics would provide the added benefit of enabling the system to be used without being plugged into an AC source and would allow the battery to be reused.

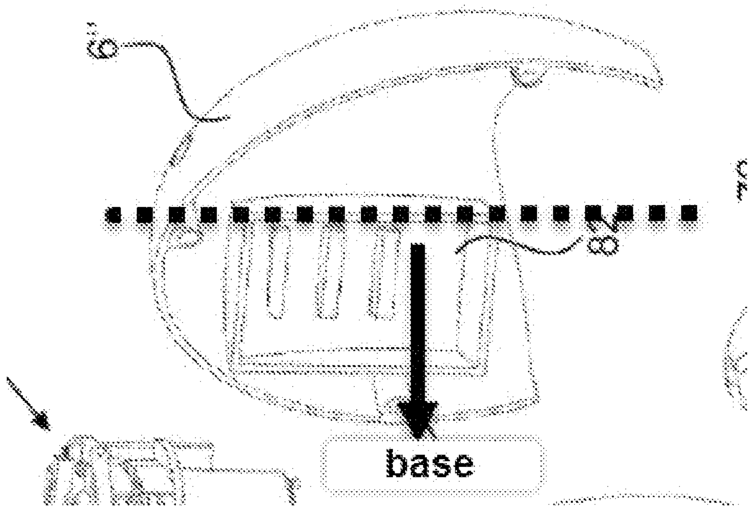
Yodfat teaches a wearable pump for transferring fluid to a body (10 in fig. 9). Yodfat further teaches that the pump comprises a housing (housing of 10 in fig. 9) which includes a rechargeable battery (240 in fig. 10; paragraph 116 discloses the energy storage can be a rechargeable battery); a power charging circuit for controlling the charging of the rechargeable battery ("recharging module" 170 in fig. 10; paragraph 125 discloses the module directs charging current to the rechargeable battery).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the device of modified Khalil to have the power charging circuit for controlling the charging of the rechargeable battery, as taught by Yodfat, for the purpose of enabling charging of the rechargeable battery while the battery is housed in the housing (paragraph 125).

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a

maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the pump of modified Khalil to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

Regarding claim 3, in the modified system of Khalil, Khalil discloses the pump is positioned at or close to the base of the housing (see below).



Regarding claim 8, in the modified system of Khalil, Khalil discloses the breast shield is a one piece item that in use presents a single continuous surface to the nipple and breast (fig. 11 shows the breast shield 1 as a one piece item).

Regarding claim 9, in the modified system of Khalil, Khalil discloses the breast shield integrates the breast flange and nipple tunnel as a one-piece item (fig. 11 shows the breast shield 1 as a one piece item).

Regarding claim 10, in the modified system of Khalil, Khalil discloses the breast flange and the nipple tunnel are a single, integral item with no joining stubs (paragraph 60 discloses that the breast shield comprises the base part and stub integrally formed; fig. 11 shows that the shield comprises the breast flange and the nipple tunnel and no other stubs are joined).

Regarding claim 11, in the modified system of Khalil, Khalil discloses the breast shield is generally symmetrical about a centre-line running from the top to the bottom of the breast shield when positioned upright for normal use (figs. 4 and 11 shows the shield being symmetrical).

Regarding claim 15, in the modified system of Khalil, Khalil discloses the breast pump device includes a diaphragm that prevents milk from reaching the pump (3 in fig. 11), and the diaphragm is a flexible membrane (paragraph 24 discloses the diaphragm 3 being a membrane made from flexible material).

Regarding claim 16, in the modified system of Khalil, Khalil discloses the diaphragm is substantially circular (fig. 11 shows the diaphragm 3 as circular) and is configured to self-seal under the negative air pressure to a substantially circular diaphragm holder that is part of the housing (fig. 5 shows the membrane sealing to holder 2; fig. 5 shows that the holder is located within the housing and is therefore considered part of the housing as the claim currently does not require the holder to be integral with the housing).

Regarding claim 18, in the modified system of Khalil, Khalil discloses the diaphragm is removable from a diaphragm holder (4 in fig. 11; paragraph 21 discloses

that the diaphragm is cleanable indicating that it must be removable from the holder 4) that sits above the breast flange and the nipple tunnel portion (fig. 4).

Regarding claim 21, in the modified system of Khalil, Khalil discloses the milk container has a surface shaped to continue a curved shape of the housing (fig. 9), so that the entire device can be held comfortably inside the bra (paragraph 70).

Regarding claim 22, in the modified system of Khalil, Khalil discloses the milk container includes a flexible valve that self-seals under negative air pressure against a milk opening in the nipple tunnel and that permits milk to flow into the milk container (non-return valve 5 in figs. 4 and 5; paragraph 69 discloses that the valve is incorporated into the milk collection container 7'; fig. 4 and 5 show the valve flexing when opening).

Regarding claim 23, in the modified system of Khalil, Khalil discloses the milk container is attachable to the housing with a mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action (the examiner notes that this limitation is being interpreted to mean a "mechanical or magnetic mechanism" as set forth on pg. 105, lines 1-2 of applicant's specification; locking lug 71 in fig. 11 is a mechanical mechanism and is disclosed to engage a recess in paragraph 69 indicating that it is capable of engaging the recess with single push action since this push action is not further defined).

Regarding claim 24, in the modified system of Khalil, Khalil discloses the milk container includes a cap that is removable from the milk container (coupling part 72 in fig. 11; paragraph 69 discloses that the part includes a non-return valve indicating that the part would necessarily have be removable in order to access the milk after

collection) and a removable valve that enables milk to pass into the milk container in one direction ("integrated valve" in paragraph 69; the valve would necessarily have to be removable since the valve is a non-return valve and would have to be removed in order to access the milk after collection).

Regarding claim 26, in the modified system of Khalil, Khalil discloses the milk container is shaped or configured to also serve as a drinking bottle that is readily held by a baby because it is wider than it is tall (fig. 11 shows the container is capable of being used as a drinking bottle since it is shown to be wider than tall).

Regarding claim 27, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the housing includes a wireless data communications system powered by the rechargeable battery.

As discussed above, Makower teaches a similar breast pump device (fig. 1b) which comprises a wireless data communications system (paragraph 11 discloses that the controller comprises a wireless transceiver to receive/send signals to an external device) which is powered by a battery (since the wireless system is disclosed to be a part of the controller in paragraph 11 and paragraph 12 discloses that the battery powers the controller, the battery must power the wireless system).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the control systems of Khalil to incorporate a wireless data communications systems, as taught by Makower. The modification of the wireless data communications system would provide the added advantage of enabling data transmission relating to pumping parameters which can

assist a user in keeping track of the volume of milk extracted and track efficiency over time, as taught by Makower (paragraph 11).

Regarding claim 28, in the modified system of Khalil, Khalil discloses the housing has a front surface that is configured to fit inside a bra and to contact an inner surface of the bra (6” in fig. 9), and a rear surface that is shaped to contact, at least in part, the breast shield (6’ in fig. 9).

Claim 2 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Tanaka (US 20170035951).

Regarding claim 2, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the pump comprises a piezo air pump system.

Tanaka teaches a breast pump system (fig. 1) which utilizes a piezoelectric pump to drive suction (15 in fig. 1; paragraph 33). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the air pump of Khalil to be a piezo air pump. This modification would provide the added advantage of reducing motor sound typically caused by electric motors, as taught by Tanaka (paragraph 47).

Claim 4 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, in further view of Chen (US 20140031744) and in further view of Mendoza (US 6227936).

Regarding claim 4, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the pump delivers in excess of 400mlBar (40 kPa) stall pressure and 1.5 litres per minute free air flow and is a lightweight air pump that enables the total mass of the breast pump system, unfilled with milk, to be less than 250gm.

It appears that the device of modified Khalil would operate equally well with the claimed stall pressure since the vacuum pump of Khalil would inherently possess some stall pressure (which is interpreted as the maximum pressure or vacuum at zero flow). Further, Applicant has not disclosed that the claimed value of the stall pressure solves any stated problem or is for any particular purpose. Instead, Applicant's specification merely states that a suitable pump usable with the breast pump system, which is currently commercially available, has the capability to exhibit the claimed stall pressure (pg. 22 of the specification). However, Applicant does not assert that this stall pressure is beneficial, or even needed, in the claimed breast pump device. It merely is an inherent property of a suitable pump usable with the breast pump system. Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified to have the pump deliver in excess of 400mBar stall pressure because it appears to be an arbitrary design consideration which fails to patentably distinguish over modified Khalil.

Chen also teaches a breast pump system (fig. 1; 30) which produces at least 9 L/min of free air flow (paragraph 39 discloses that the vacuum source as a flow rate of not lower than 9 L/min; the examiner notes that Applicant's specification does not provide a definition for "free air flow", as such, the flow rate of Chen is considered to be

equivalent to the claimed “free air flow” since the vacuum source of Chen is delivering air, as disclosed in paragraph 39). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the breast pump system of modified Khalil to have an air flow rate of not less than 9 L/min for the purpose of establishing an effective suckling frequency, as taught by Chen (paragraph 39).

Finally, Mendoza teaches a bra which is designed to support a breast pump to allow the mother’s hands to remain free (1:8-12). Mendoza further discloses that the bra must be able to support up to 8 ounces when the pump is full (1:58-62). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the system of modified Khalil to be a lightweight air pump that enables the total weight of the system, unfilled with milk, to be less than 250gm, as taught by Mendoza since Mendoza teaches that a lightweight system is crucial for enabling the system to be supported by a bra.

Claim 5 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, in further view of Baker (US 20090281485).

Regarding claim 5, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the breast pump device makes less than 30dB noise at maximum power and less than 25dB at normal power, against a 20dB ambient noise.

Baker is directed towards a device for removing fluid from a body (fig. 6) using a vacuum pump embodied as a motor (motor 9 in fig. 6; paragraph 243). Baker further

teaches that the device makes less than 20 decibel of noise at full power (paragraph 121) by sound proofing the walls of the housing and by adding a counter balance to the motor (paragraph 144). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the device of modified Khalil to have the device make less than 20 dB of noise during maximum power for the purpose of making the device for discrete and comfortable for the user and others around the user.

Claim 6 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Vogelin (US 20070179439).

Regarding claim 6, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the breast shield is substantially rigid.

Vogelin is directed towards a breast pump system (fig. 1) having a breast shield (3 in fig. 1) which is made from a polypropylene, which is a known rigid material (paragraph 62). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the breast shield of modified Khalil to be made from polypropylene for the purpose of enabling the shield to be sterilized (paragraph 62).

Claim 7 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Rigert (US 20180028733).

Regarding claim 7, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above. Further, the breast shield of Khalil appears capable of rotating smoothly around a nipple inserted into the nipple tunnel since the claim does not require the shield to be fully attached during rotation; however, modified Khalil does not explicitly teach or disclose the breast shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto the breast.

Rigert teaches a breast shield system (1 in fig. 1) for a breast pump which comprises a shield (10 in fig. 2). Rigert further teaches that the shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto the breast (paragraph 15 discloses that the shield can be rotated to determine the optimal level of comfort for a user depending on breast size and shape; the examiner notes that the shield of Rigert is capable of rotating smoothly since fig. 2 shows the interior of the shield is smooth and the size of the nipple relative to the nipple tunnel is not defined). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the shield of modified Khalil to be configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto the breast for the purpose of finding the optimal position for the user's breast shape and size.

Claim 13 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Guthrie (US 20160220745).

Regarding claim 13, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above. Khalil further discloses that the housing is configured to couple to the breast shield via a securing lip and flange arrangement (paragraph 48). However, modified Khalil does not explicitly teach or disclose the housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.

Guthrie is directed to a breast pump system (fig. 2A) having a breast shield (201 in fig. 2A) coupled to a housing (204 in fig. 2A) via a variety of detachable mechanisms including a threaded attachment (paragraph 39). The examiner notes that this threaded attachment would enable the breast shield to attach to the housing in a sliding manner since the term “sliding” is interpreted to mean “to move smoothly along a surface” using the threads as guide members. Accordingly, the prior art references teach that it is known that securing lip/flange and threads are elements that are functional equivalents for providing for a detachable connection. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was filed to have substituted a securing lip/flange for threads. The substitution would have resulted in an equivalent breast shield functionally capable of being engaging and disengaging from the housing.

Claim 14 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Miller (US 20160325031).

Regarding claim 14, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above. Further Khalil appears capable of only having the breast shield and milk container be removed during normal use or normal disassembly

(paragraphs 48 and 49 disclose that the shield is made from an elastic material which can be manipulated to remove the securing lip from the housing; paragraph 69 discloses the milk collection container is releasably connected to the housing). However, modified Khalil does not explicitly teach or disclose the breast pump device includes only two parts that are directly removable from the housing in normal use or normal dis-assembly: the breast shield and the milk container.

Miller teaches a breast pump system (fig. 3A) in which the breast shield and milk container are capable of being disconnected from the rest of the system (paragraph 29). Since Miller teaches that only these components need cleaning (paragraph 29), it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the device of Khalil to include only two parts that are directly removable from the housing in normal use or normal dis-assembly: the breast shield and the milk container, for the purpose of enabling easy cleaning on the shield and container.

Claim 19 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Phillips (US 20160296682).

Regarding claim 19, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above. Although it appears based on fig. 11 of Khalil that the container would be rigid, modified Khalil does not explicitly teach or disclose this limitation.

Phillips teaches a breast pump system (fig. 1) comprising a milk collection container (“collection container” 120 in fig. 1) which is substantially rigid (paragraph 57

discloses the container being made from Tritan; pg. 21 of Applicant's specification discloses that Tritan is a polycarbonate material, which is a known rigid material). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the container of modified Khalil to be made Tritan for the purpose of enabling the container to maintain its strength when a vacuum is applied, as taught by Phillips (paragraph 57).

Claim 20 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Thompson (US 7662018).

Regarding claim 20, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above. Khalil further discloses that the milk container is configured to attach to a lower part of the housing (fig. 9). Khalil further appears to disclose the milk container forms a flat bottomed base for the device (figs. 9-11); however, modified Khalil does not explicitly teach this limitation.

Thompson teaches a system (fig. 4) having a milk container (30 in fig. 4) which has a lower surface which is flat (38 in fig. 5) and provides a base that enables the entire system to stand upright (fig. 5; 5:28-34). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the container of modified Khalil to have a lower surface that is flat and provides a base that enables the entire system to stand upright since Thompson teaches that this arrangement is advantageous as it allows the system to be placed on a table (5:28-34).

Claim 25 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers,

as applied to claim 1 above, and further in view of Guthrie (US 20160220743), hereinafter referred to as “Guthrie ‘743”.

Regarding claim 25, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above. Khalil further discloses the top of the container includes an optically clear region (paragraph 69 discloses the container is transparent in its entirety). However, modified Khalil does not teach or disclose the top is aligned below one or more light emitters positioned in the base of the housing.

Guthrie ‘743 teaches a breast pump system (fig. 8) having a milk collection container (fig. 8) and a housing (808 in fig. 8). Guthrie ‘743 further teaches that the system can include a sensor subsystem comprising at least one light emitter (603 in fig. 6a) to emit a light to at least one light detector (604 in fig. 6a; paragraph 63) for the purpose of calculating milk volume (paragraph 63). Guthrie ‘743 further teaches that this sensor subsystem may be placed in the base of the housing so it is aligned with the top of the milk container (fig. 8). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the housing of modified Khalil to include the light emitter and light detector in the base of the housing, as taught by Guthrie ‘743, for the purpose of calculating expressed milk volume.

Claims 29 and 30 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil in view of Makower in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Makower (US 20160206794), hereinafter referred to as “Makower ‘794”.

Regarding claim 29, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the housing includes a visual and/or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

Makower ‘794 teaches a similar breast pump system (100 in fig. 1) having a visual indicator that indicates whether milk is flowing or not flowing into the milk container (250 in fig. 6; paragraph 163 discloses that the display indicates the volume and flow rate of the milk being expressed which is indicative of whether milk is flowing or not flowing). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the display of modified Khalil to be capable of displaying volume and flow rate, as taught by Makower ‘794. This modification would enable a user to keep track of milk expression data to monitor pumping efficiency over time.

Regarding claim 30, modified Khalil teaches all of the claimed limitations set forth in claim 1, as discussed above, but does not teach or disclose the housing includes a visual and/or haptic indicator that indicates if the pump is operating correctly to pump milk, based on whether the quantity and/or the height of the liquid in the milk container above its base is increasing above a threshold rate of increase.

Makower ‘794 teaches a similar breast pump system (100 in fig. 1) having a visual indicator (display 250 in fig. 6) that indicates if the pumping mechanism is operating correctly to pump milk, based on whether the quantity and/or the height of the liquid in the container above its base is increasing above a threshold rate of increase (the examiner notes the threshold rate of increase has not been defined; as such,

paragraph 163 discloses that the display displays a quantity of liquid in the container, i.e. volume of milk volume having been expressed, and paragraph 247 discloses that the display displays this information in real-time - indicating that the display is functionally capable of indicating if the pump is operating correctly based on the quantity of liquid if the container is increasing above a threshold rate of increase). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the display of modified Khalil to be capable of displaying volume and flow rate in real-time, as taught by Makower '794. This modification would enable a user to keep track of milk expression data to monitor pumping efficiency over time.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*,

686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1-11 and 13-30 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-35 of U.S. Patent No. 10,926,011 in view of the teachings below (see table below).

Claim 1 of the issued patent discloses all of the claimed limitations of claim 1 of the application except a rechargeable battery; a power charging circuit for controlling the charging of the rechargeable battery; control electronics powered by the rechargeable battery; the breast shield having a breast flange and nipple tunnel; and the pump generates a maximum suction of approximately 240 mmHg.

Additionally, claim 1 of the issued patent includes additional features not recited in the application claims, thus the patent claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Khalil teaches a breast pump system (fig. 10) having a breast shield (1 in fig. 11) with a flange (12 in fig. 7) and a nipple tunnel (13 in fig. 7). Khalil further teaches the housing (6" in fig. 10) has control electronics (84 in fig. 9). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the breast shield and housing of claim 1 of the patent to have a flange/nipple tunnel and control electronics, respectively. This configuration of the breast shield is known in the art and provides for a surface for contacting the breast and receiving the nipple. The modification of the control electronics would provide for user input to enable a user to active the pump (paragraph 68).

Makower is directed towards a substantially similar breast pump device (fig. 1b) which has a housing (main body 34 in fig. 1a) that includes a battery (battery 48 in fig. 14a) capable of being recharged (paragraph 151 teaches that the battery can be recharged) and operable to power the control electronics (controller 52 in fig. 14a; paragraph 12 teaches the battery is electrically connected to the controller) and the

pump (drivers 46 and 44 in fig. 14a; paragraph 12 teaches the battery is electrically connected to the pump). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the device of claim 1 of the patent to have a rechargeable battery, as taught by Makower. The modification of the rechargeable battery coupled to the pump and control electronics would provide the added benefit of enabling the system to be used without being plugged into an AC source and would allow the battery to be reused.

Yodfat teaches a wearable pump for transferring fluid to a body (10 in fig. 9). Yodfat further teaches that the pump comprises a housing (housing of 10 in fig. 9) which includes a rechargeable battery (240 in fig. 10; paragraph 116 discloses the energy storage can be a rechargeable battery); a power charging circuit for controlling the charging of the rechargeable battery ("recharging module" 170 in fig. 10; paragraph 125 discloses the module directs charging current to the rechargeable battery).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the device claim 1 of the patent to have the power charging circuit for controlling the charging of the rechargeable battery, as taught by Yodfat, for the purpose of enabling charging of the rechargeable battery while the battery is housed in the housing (paragraph 125).

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be "approximately" 240 mmHg).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the patent to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	011 Claims	Teaching
1		Teachings discussed above
2	1	
3	3	
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5	10	
6		Vogelin teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
7		Rigert teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
8	1+30	
9		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
10		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14	13	
15	1	

16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.
17	32	
18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned.
19	24	
20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.
21	24	
22		Khalil teaches the claimed matter, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of providing a non-return valve which prevents milk from exiting the container.
23	25	
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25		Khalil and Guthrie '743 teaches the claimed matter, as discussed on pg. 20. It would have been obvious to have modified the claim of the reference application for the same reasons.
26	27	
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29	15	
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

Claims 1-11 and 13-30 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-28 of U.S. Patent No. 10,881,766 in view of the teachings below.

Although the claims at issue are not identical, they are not patentably distinct from each other because all of the elements of the application claims can be found in the patent claim. With regard to claim 1 of the instant application, claim 1 of the patent discloses a housing (claim 1); a rechargeable battery (claim 1), a pump generating negative air pressure (claim 1); a breast shield having a flange and nipple tunnel (claim 1); and a milk container that is configured to be attached to and removed from the housing (claim 1).

Thus, claim 1 of the issued patent claims all of the claimed limitations of claim 1 of the application except a power charging circuit for controlling the charging of the rechargeable battery; control electronics powered by the rechargeable battery; and the pump generates a maximum suction of approximately 240 mmHg.

Khalil teaches a breast pump which is a self-contained, in bra device (fig. 9) which comprises control electronics (84 in fig. 9; paragraph 68). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the system of claim 1 of the ‘766 patent to comprise control electronics for the purpose of enabling a user to activate the pump and enter user commands (paragraph 68).

Yodfat teaches a wearable pump for transferring fluid to a body (10 in fig. 9). Yodfat further teaches that the pump comprises a housing (housing of 10 in fig. 9) which includes a rechargeable battery (240 in fig. 10; paragraph 116 discloses the energy

storage can be a rechargeable battery); a power charging circuit for controlling the charging of the rechargeable battery ("recharging module" 170 in fig. 10; paragraph 125 discloses the module directs charging current to the rechargeable battery). Yodfat further teaches control electronics (processor 133 in fig. 10) powered by the rechargeable battery (fig. 10).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the system of claim 1 of the '766 patent to have the power charging circuit for controlling the charging of the rechargeable battery and to have the control electronics powered by the rechargeable battery, as taught by Yodfat, for the purpose of enabling charging of the rechargeable battery while the battery is housed in the housing (paragraph 125).

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be "approximately" 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the '766 patent to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'766 Claims	Teaching
1		Teachings discussed above
2	18	

3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5		Baker teaches the claimed matter on pg. 15 above. It would have been obvious to have modified the claim of the reference application for the same reason.
6		Vogelin teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
7		Rigert teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
8	7	
9	27	
10	27	
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
13	9	
14	11	
15	1	
16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.
17	1	
18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned and to provide a connection from the nipple tunnel to the milk container (fig. 10).
19	1	
20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.

21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22	5	
23	2	
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25		Khalil and Guthrie '743 teaches the claimed matter, as discussed on pg. 20. It would have been obvious to have modified the claim of the reference application for the same reasons.
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29	22	
30	22	

Claims 1-11, 13-16, and 18-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/181,057 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1 of the ‘057 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a

rechargeable battery (claim 1); (c) control electronics (claim 1); (d) an air pump generating negative air pressure (claim 1), (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘057 includes additional features not recited in the instant application claims, thus the ‘057 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘057 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘057 does not claim a power charging circuit for controlling the charging of the rechargeable battery and the control electronics and the air pump being powered by rechargeable battery; the pump generating a maximum suction of approximately 240mmHg.

Makower (US 20170072118) is directed towards a substantially similar breast pump device (fig. 1b) which has a housing (main body 34 in fig. 1a) that includes a battery (battery 48 in fig. 14a) capable of being recharged (paragraph 151 teaches that the battery can be recharged) and operable to power the control electronics (controller 52 in fig. 14a; paragraph 12 teaches the battery is electrically connected to the controller) and the pump (drivers 46 and 44 in fig. 14a; paragraph 12 teaches the battery is electrically connected to the pump). It would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘057 application to have the rechargeable battery which powers the control electronics and pump. The modification of the rechargeable battery coupled to the pump and control electronics would provide the added benefit of enabling the

system to be used without being plugged into an AC source and would allow the battery to be reused.

Yodfat (US 20110009824) teaches a wearable pump for transferring fluid to a body (10 in fig. 9). Yodfat further teaches that the pump comprises a housing (housing of 10 in fig. 9) which includes a rechargeable battery (240 in fig. 10; paragraph 116 discloses the energy storage can be a rechargeable battery); a power charging circuit for controlling the charging of the rechargeable battery ("recharging module" 170 in fig. 10; paragraph 125 discloses the module directs charging current to the rechargeable battery). It would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the device of claim 1 of the '057 application to have the power charging circuit for controlling the charging of the rechargeable battery, as taught by Yodfat, for the purpose of enabling charging of the rechargeable battery while the battery is housed in the housing (paragraph 125).

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be "approximately" 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the '057 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'057 Claims	Teaching
1		Teachings discussed above
2	19	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5	30	
6	3	
7	6	
8	7	
9	8	
10		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
11	9	
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14		Miller teaches the claimed matter on pg. 18 above. It would have been obvious to have modified the claim of the reference application for the same reason.
15		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of transmitting suction to the nipple for milk expression (paragraph 63 of Khalil).
16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.
18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned.
19	12	

20	14	Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.
21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22		Khalil teaches the claimed matter, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of providing a non-return valve which prevents milk from exiting the container.
23	15	
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25		Khalil and Guthrie '743 teaches the claimed matter, as discussed on pg. 20. It would have been obvious to have modified the claim of the reference application for the same reasons.
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

This is a provisional nonstatutory double patenting rejection.

Claims 1-11, 13-16, and 18-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203079 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1 of the ‘079 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘079 includes additional features not recited in the instant application claims, thus the ‘079 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘079 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘079 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum

suction close to 250 mmHg which is considered to be “approximately” 240 mmHg).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘079 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'079 Claims	Teaching
1		Teachings discussed above
2		Tanaka teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5		Baker teaches the claimed matter on pg. 15 above. It would have been obvious to have modified the claim of the reference application for the same reason.
6		Vogelin teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
7		Rigert teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
8		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
9		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.

10		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14		Miller teaches the claimed matter on pg. 18 above. It would have been obvious to have modified the claim of the reference application for the same reason.
15		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of transmitting suction to the nipple for milk expression (paragraph 63 of Khalil).
16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.
18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned.
19		Phillips teaches the claimed matter on pg. 19 above. It would have been obvious to have modified the claim of the reference application for the same reason.
20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.
21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22		Khalil teaches the claimed matter, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of providing a non-return valve which prevents milk from exiting the container.

23		Khalil teaches the claimed matter, as discussed on pg. 1`. It would have been obvious to have modified the claim of the reference application for the purpose of providing a releasable connection between the pump and the container, as taught by Khalil (paragraph 69).
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25	11	
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203109 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘109 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device

(preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘109 includes additional features not recited in the instant application claims, thus the ‘109 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘109 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘109 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘109 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'109 Claims	Teaching
1		Teachings discussed above
2	1	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5	19	
6	20	
7	21	
8	22	
9	22	
10	22	
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
12	23	
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14	24	
15		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of transmitting suction to the nipple for milk expression (paragraph 63 of Khalil).
16	26	
17	27	
18	28	
19	29	
20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.

21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22		Khalil teaches the claimed matter, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of providing a non-return valve which prevents milk from exiting the container.
23	30	
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25		Khalil and Guthrie '743 teaches the claimed matter, as discussed on pg. 20. It would have been obvious to have modified the claim of the reference application for the same reasons.
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203150 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘150 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘150 includes additional features not recited in the instant application claims, thus the ‘150 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘150 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘150 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘150 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	150 Claims	Teaching
1		Teachings discussed above
2	28	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4	29	
5	30	
6	2	
7	3	
8	4	
9	5	
10	6	
11	7	
12	8	
13	9	
14	10	
15	11	
16	12	
17	13	
18	14	
19	15	
20	16	
21	17	
22	18	
23	19	
24	20	
25	21	
26	22	

27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203179 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘179 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘179 includes additional features not recited in the instant application claims, thus the ‘179 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘179 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘179 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be "approximately" 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the '179 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'179 Claims	Teaching
1		Teachings discussed above
2	28	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4	29	
5	30	
6	10	
7	11	
8	12	
9	13	
10	14	
11	15	
12	16	
13	17	
14	18	

15	19	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an under pressure by flexing (paragraph 17).
16	20	
17	21	
18	22	
19	2	
20	3	
21	4	
22	5	
23	6	
24	7	
25	8	
26	9	
27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Claims 1-11, 13-16, and 18-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 and 6 of copending Application No. 17/203216 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘216 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast

flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of '216 includes additional features not recited in the instant application claims, thus the '216 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of '216 claims all of the claimed limitations set forth in claim 1 of the instant application except in that '216 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be "approximately" 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the '216 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'216 Claims	Teaching
1		Teachings discussed above
2		Tanaka teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.

3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5		Baker teaches the claimed matter on pg. 15 above. It would have been obvious to have modified the claim of the reference application for the same reason.
6		Vogelin teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
7		Rigert teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
8		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
9		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
10		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14		Miller teaches the claimed matter on pg. 18 above. It would have been obvious to have modified the claim of the reference application for the same reason.

15		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of transmitting suction to the nipple for milk expression (paragraph 63 of Khalil).
16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.
18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned.
19		Phillips teaches the claimed matter on pg. 19 above. It would have been obvious to have modified the claim of the reference application for the same reason.
20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.
21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22		Khalil teaches the claimed matter, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of providing a non-return valve which prevents milk from exiting the container.
23		Khalil teaches the claimed matter, as discussed on pg. 1`. It would have been obvious to have modified the claim of the reference application for the purpose of providing a releasable connection between the pump and the container, as taught by Khalil (paragraph 69).
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25	6	

26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

This is a provisional nonstatutory double patenting rejection.

Claims 1-11, 13-16, and 18-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203259 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1 of the ‘259 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast

flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘259 includes additional features not recited in the instant application claims, thus the ‘259 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘259 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘259 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘259 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'259 Claims	Teaching
1		Teachings discussed above
2	28	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).

4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5	30	
6		Vogelin teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
7		Rigert teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
8		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
9		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
10		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14		Miller teaches the claimed matter on pg. 18 above. It would have been obvious to have modified the claim of the reference application for the same reason.
15		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of transmitting suction to the nipple for milk expression (paragraph 63 of Khalil).
16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.

18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned.
19	22	
20	23	
21	24	
22	25	
23	26	
24	27	
25	15	
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27	21	
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29	18	Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30	19	

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203292 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1 of the ‘292 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging

of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘292 includes additional features not recited in the instant application claims, thus the ‘292 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘292 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘292 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘292 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	**'292 Claims**	**Teaching**
1		Teachings discussed above
2	28	

3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4	29	
5	30	
6	2	
7	3	
8	4	
9	5	
10	6	
11	7	
12	8	
13	9	
14	10	
15	11	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an underpressure by flexing (paragraph 17).
16	12	
17	13	
18	14	
19	15	
20	16	
21	17	
22	18	
23	19	
24	20	
25	21	
26	22	
27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-29 of copending Application No. 17/203313 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘313 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘313 includes additional features not recited in the instant application claims, thus the ‘313 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘313 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘313 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘313 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'313 Claims	Teaching
1		Teachings discussed above
2	1	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
5	15	
6	16	
7	17	
8	18	
9	18	
10	18	
11	19	
12	20	
13	21	
14	22	
15	23	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an underpressure by flexing (paragraph 17).
16	24	
17	25	
18	26	
19	27	

20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.
21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22	28	
23	29	
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25		Khalil and Guthrie '743 teaches the claimed matter, as discussed on pg. 20. It would have been obvious to have modified the claim of the reference application for the same reasons.
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.
28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of copending Application No. 17/203327 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘327 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘327 includes additional features not recited in the instant application claims, thus the ‘327 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘327 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘327 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg).

Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘327 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'327 Claims	Teaching
1		Teachings discussed above
2	28	
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4	29	
5	30	
6	2	
7	3	
8	4	
9	5	
10	6	
11	7	
12	8	
13	9	
14	10	
15	11	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an underpressure by flexing (paragraph 17).
16	12	
17	13	
18	14	
19	15	
20	16	
21	17	
22	18	
23	19	

24	20	
25	21	
26	22	
27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-31 of copending Application No. 17/203355 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘355 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘355 includes additional features not recited in the instant application claims, thus the ‘355 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘355 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘355 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump ("pump mechanism" 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be "approximately" 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the '355 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'355 Claims	Teaching
1		Teachings discussed above
2	28	
3	29	
4	30	
5	31	
6	2	
7	3	
8	4	
9	5	
10	6	
11	7	
12	8	
13	9	
14	10	
15	11	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an underpressure by flexing (paragraph 17).
16	12	
17	13	
18	14	

19	15	
20	16	
21	17	
22	18	
23	19	
24	20	
25	21	
26	22	
27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Claims 1-11, 13-16, and 18-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 and 9 of copending Application No. 17/203384 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1 of the '384 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of '384 includes additional features not recited in the instant application claims, thus the '384 claim is more specific. It has been held

that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘384 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘384 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘384 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'384 Claims	Teaching
1		Teachings discussed above
2		Tanaka teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.
3		Khalil teaches the claimed limitation on pg. 9 above. It would have been obvious to have modified the claim of the reference application for the purpose of providing an optimally arranged breast pump which can be hands-free and worn in a bra (paragraph 70).
4		Chen and Mendoza teaches the claimed matter on pg. 13 above. It would have been obvious to have modified the claim of the reference application for the same reason.

5		Baker teaches the claimed matter on pg. 15 above. It would have been obvious to have modified the claim of the reference application for the same reason.
6		Vogelin teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
7		Rigert teaches the claimed matter on pg. 16 above. It would have been obvious to have modified the claim of the reference application for the same reason.
8		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
9		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
10		Khalil teaches the claimed limitation, as discussed on pg. 9. It would have been obvious to have modified the claim the reference application for the purpose of obviating the need for separate pieces which would increase the risk of leakage.
11		Khalil teaches the claimed limitation, as discussed on pgs. 9 and 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling a user to place the shield on the breast without concern of proper orientation.
13		Guthrie teaches the claimed matter on pg. 17 above. It would have been obvious to have modified the claim of the reference application for the same reason.
14		Miller teaches the claimed matter on pg. 18 above. It would have been obvious to have modified the claim of the reference application for the same reason.
15		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of transmitting suction to the nipple for milk expression (paragraph 63 of Khalil).
16		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this shape is sufficient to transfer suction to the nipple.

18		Khalil teaches the claimed limitations, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of enabling the diaphragm to be replaced and/or cleaned.
19		Phillips teaches the claimed matter on pg. 19 above. It would have been obvious to have modified the claim of the reference application for the same reason.
20		Thompson teaches the claimed matter on pg. 20 above. It would have been obvious to have modified the claim of the reference application for the same reason.
21		Khalil teaches the claimed limitations, as discussed on pg.10. it would have been obvious to have modified the claim of the reference application to have the claimed feature since it provides a hands-free breast pump unit which can be worn inside the bra (paragraph 70).
22		Khalil teaches the claimed matter, as discussed on pg. 10. It would have been obvious to have modified the claim of the reference application for the purpose of providing a non-return valve which prevents milk from exiting the container.
23		Khalil teaches the claimed matter, as discussed on pg. 1`. It would have been obvious to have modified the claim of the reference application for the purpose of providing a releasable connection between the pump and the container, as taught by Khalil (paragraph 69).
24		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application for enabling a user to access the milk after collection and for preventing milk from getting suctioned back into the pump.
25	9	
26		Khalil teaches the claimed matter, as discussed on pg. 11. It would have been obvious to have modified the claim of the reference application since Khalil teaches that this configuration helps provide a hands-free pump which can be worn in a bra (paragraph 70).
27		Makower teaches the claimed matter, as discussed on pg. 12. It would have been obvious to have modified the claim of the reference application for the same reasons.

28		Khalil teaches the claimed matter of claim 25, as discussed on pg. 13. It would have been obvious to have modified the claim of the reference application since Khalil teaches this arrangement is beneficial in providing a hands-free breast pump which can be worn in a bra (paragraph 70).
29		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.
30		Makower '794 teaches the claimed matter, as discussed on pg. 21. It would have been obvious to have modified the claim of the reference application for the same reasons.

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-31 of copending Application No. 17/203397 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘397 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘397 includes additional features not recited in the instant application claims, thus the ‘397 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘397 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘397 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘397 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'397 Claims	Teaching
1		Teachings discussed above
2	28	
3	29	
4	30	
5	31	
6	2	
7	3	
8	4	
9	5	
10	6	
11	7	
12	8	
13	9	
14	10	

15	11	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an underpressure by flexing (paragraph 17).
16	12	
17	13	
18	14	
19	15	
20	16	
21	17	
22	18	
23	19	
24	20	
25	21	
26	22	
27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Claims 1-30 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-31 of copending Application No. 17/203418 in view of the teachings below (see table below).

With regard to **claim 1** of the application, claim 1of the ‘418 application discloses a breast pump device that is configured as a self-contained, in-bra wearable device (preamble of claim 1), and that includes: (i) a housing (claim 1) that includes (a) a rechargeable battery (claim 1); (b) a power charging circuit for controlling the charging of the rechargeable battery (claim 1) ; (c) control electronics powered by the rechargeable battery (claim 1); (d) a pump powered by the rechargeable battery and generating negative air pressure (claim 1); (ii) a breast shield made up of a breast

flange and a nipple tunnel (claim 1); and (iii) a milk container that is configured to attach to the housing (claim 1). Further, claim 1 of ‘418 includes additional features not recited in the instant application claims, thus the ‘418 claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Thus, claim 1 of ‘418 claims all of the claimed limitations set forth in claim 1 of the instant application except in that ‘418 does not claim the pump generating a maximum suction of approximately 240mmHg.

Myers teaches a similar breast pump system (fig. 1) which is configured as a hands-free, in-bra system (paragraph 10) which comprises a vacuum pump (“pump mechanism” 50 in fig. 10; paragraph 60) which generates negative air pressure with a maximum suction of approximately 240 mmHg (paragraph 72 discloses a maximum suction close to 250 mmHg which is considered to be “approximately” 240 mmHg). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the ‘418 application to be configured to generate a maximum suction of approximately 240 mmHg, as taught by Myers, since Myers teaches that this suction level was found to perform acceptably in live nursing adult women (paragraph 72).

'050 Claims	'418 Claims	Teaching
1		Teachings discussed above
2	28	
3	29	
4	30	
5	31	
6	2	
7	3	

8	4	
9	5	
10	6	
11	7	
12	8	
13	9	
14	10	
15	11	Khalil teaches the membrane is flexible (paragraph 24). It would have been obvious to have modified the claim of the reference application for the purpose of enabling the membrane to generate an underpressure by flexing (paragraph 17).
16	12	
17	13	
18	14	
19	15	
20	16	
21	17	
22	18	
23	19	
24	20	
25	21	
26	22	
27	24	
28	25	
29	26	
30	27	

This is a provisional nonstatutory double patenting rejection.

Allowable Subject Matter

Excepting the 112(b) and double patenting rejections above, **claim 12** is allowable over the prior art.

The following is a statement of reasons for the indication of allowable subject matter: The closest piece of prior art is Khalil. Khalil does not teach or disclose a

breast shield configured to slide in and out from the housing together with the diaphragm on guide members in the breast shield. The examiner notes that the term "together" is interpreted to mean that the breast shield and the diaphragm move at the same time and further notes that this interpretation appears consistent with Applicant's specification (paragraph 82 discloses that the breast shield holds the diaphragm and would, therefore, move with the diaphragm). Instead, Khalil discloses a substantially similar, self-contained, in-bra breast pump system (fig. 10) which comprises a breast shield (1 in fig. 11), a diaphragm (3 in fig. 11), and a housing (6' and 6" snap together to form a housing). Fig. 4 shows that the shield is engaged to the housing through a lip 11 and is capable of being removed from the housing. However, the diaphragm (3) is shown in fig. 10 to be positioned between the housing parts (6' and 6") so that the diaphragm holder pieces (2 and 4 in fig. 11) engage the vacuum pump (81 in fig. 11) through a hose (80 in fig. 10) and the milk container (7' in fig. 11). In order to remove the diaphragm from the housing, a user would need for first remove the breast shield from the housing in order to access the diaphragm through the opening in housing part 6' in order to disconnect the diaphragm from the vacuum pump for removal. For this reason, the diaphragm of Khalil is incapable of sliding together with the shield from the housing nor would a PHOSITA be motivated to modify the device of Khalil to perform this function.

Excepting the double patenting rejections above and the 112(b) rejection above, **claim 17** is allowable over the prior art.

The following is a statement of reasons for the indication of allowable subject matter: The closest piece of prior art is Khali. However, Khalil does not teach or

disclose a diaphragm holder that is formed as a recess in a rear surface of the housing. Instead, Khalil teaches a diaphragm holder (2 and 4 in fig. 11) which are seated in a space formed between housing parts 6' and 6" in fig. 11. As such, Khalil cannot be considered to teach or disclose a holder which is formed as a recess in a rear surface nor would a PHOSITA be motivated to modify the device of Khalil to meet this limitation.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY FREDRICKSON whose telephone number is (571)270-7481. The examiner can normally be reached on Monday-Friday (9 AM - 5 PM EST).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, NATHAN PRICE can be reached on 571-270-5421. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY B FREDRICKSON/
Examiner, Art Unit 3783

Notice of References Cited	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.	
	Examiner COURTNEY FREDRICKSON	Art Unit 3783	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20090281485-A1	11-2009	BAKER; PETER CHRISTENSEN	A61M1/0058	604/35
*	B	US-20140031744-A1	01-2014	CHEN; CHEAN-SHUI	A61M1/066	604/74
*	C	US-20160220743-A1	08-2016	Guthrie; Gabrielle V.	G16H40/63	1/1
*	D	US-20160220745-A1	08-2016	Guthrie; Gabrielle V.	A61M1/06	1/1
*	E	US-20130023821-A1	01-2013	KHALIL; Gamal	A61M1/82	604/74
*	F	US-20170072118-A1	03-2017	Makower; Joshua	A61M1/062	1/1
*	G	US-20160206794-A1	07-2016	MAKOWER; JOSHUA	A61M1/064	1/1
*	H	US-20160325031-A1	11-2016	Miller; Jared	A61M39/24	1/1
*	I	US-6227936-B1	05-2001	Mendoza; Amelia	A41C3/04	2/104
*	J	US-20080275386-A1	11-2008	Myers; Kenneth E.	A61M1/064	604/74
*	K	US-20160296682-A1	10-2016	Phillips; Andrew Luke	A61J13/00	1/1
*	L	US-20180028733-A1	02-2018	Rigert; Mario	A61M1/064	1/1
*	M	US-20170035951-A1	02-2017	TANAKA; Nobuhira	A61M1/064	1/1

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.	
	Examiner COURTNEY FREDRICKSON	Art Unit 3783	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-7662018-B1	02-2010	Thompson; Pamela J.	A61J13/00	450/37
*	B	US-20070179439-A1	08-2007	Vogelin; Stefan	F16K15/144	604/74
*	C	US-20110009824-A1	01-2011	Yodfat; Ofer	A61M5/1723	604/151
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.
	Examiner COURTNEY FREDRICKSON	Art Unit 3783

CPC - Searched*		
Symbol	**Date**	**Examiner**
a61m1/06, 1/062, 1/066; a61j13/00; a41c4/04	06/19/2021	cbf

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
see SEARCH history	06/19/2021	cbf
searched inventors in SEARCH and PALM	06/19/2021	cbf
Consulted parent history	06/19/2021	cbf

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

/COURTNEY B FREDRICKSON/
Examiner, Art Unit 3783

Index of Claims	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.
	Examiner COURTNEY FREDRICKSON	Art Unit 3783

✓	Rejected		-	Cancelled		N	Non-Elected		A	Appeal
=	Allowed		÷	Restricted		I	Interference		O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2021								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								
	21	✓								
	22	✓								
	23	✓								
	24	✓								
	25	✓								
	26	✓								
	27	✓								
	28	✓								
	29	✓								
	30	✓								

Bibliographic Data

Application No: 17/203,050

Foreign Priority claimed: ☒ Yes ☐ No

35 USC 119 (a-d) conditions met: ☒ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /COURTNEY B FREDRICKSON/

Examiner's Signature

Initials

Title: BREAST PUMP SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/16/2021	604	3783	373499.00050
RULE			

APPLICANTS

CHIARO TECHNOLOGY LIMITED, London, UNITED KINGDOM

INVENTORS

Jonathan O'TOOLE, London, UNITED KINGDOM

Adam ROLLO, London, UNITED KINGDOM

Andrew CARR, London, UNITED KINGDOM

CONTINUING DATA

This application is a CON of 17181057 02/22/2021

17181057 is a CON of 16009547 06/15/2018 PAT 10926011

FOREIGN APPLICATIONS

UNITED KINGDOM GB1709564.7 06/15/2017

UNITED KINGDOM GB1709561.3 06/15/2017

UNITED KINGDOM GB1709566.2 06/15/2017

UNITED KINGDOM GB1809036.5 06/01/2018

IF REQUIRED, FOREIGN LICENSE GRANTED**

03/24/2021

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED KINGDOM

ADDRESS

Saul Ewing Arnstein & Lehr LLP (Philadelphia)
Attn: Patent Docket Clerk
Centre Square West
1500 Market Street, 38th Floor

Philadelphia, PA 19102-2186
UNITED STATES

FILING FEE RECEIVED

$3,710

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	268	a61m1/$.cpc. AND ((breast milk) WITH pump$4) AND ((power$4 battery) WITH (charg$4 recharg$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/12 04:05 PM
L2	65	("20020193731"|"20040056641"|"20040074281"|"20040267215"|"20050219302"|"20060122575"|"20070051172"|"20070051727"|"20080262420"|"20120277636"|"20140052056"|"20150217036"|"20150217037"|"20150283311"|"20160000980"|"20160058929"|"20160082165"|"20160082166"|"20160151551"|"20160158424"|"20160206794"|"20160220743"|"20160220745"|"20160287767"|"20160296681"|"20160310650"|"20170021068"|"20170035951"|"20170143879"|"20170220753"|"20180021490"|"2849881"|"4390024"|"5474683"|"5941847"|"5973770"|"6045529"|"6090065"|"6383163"|"6440100"|"6461324"|"6547756"|"6579258"|"6663587"|"6749582"|"7048519"|"7201735"|"7312554"|"7314400"|"7776008"|"8057425"|"8118772"|"8187227"|"8262606"|"8282596"|"8376986"|"8702646"|"8801495"|"8876760"|"8926556"|"9033913"|"9173587"|"9345274"|"9539377"|"D548831").PN.	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/07 01:17 PM
L3	214	(jonathan near3 o'toole).inv. (adam near3 rollo).inv. (andrew near3 carr).inv.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 01:42 PM
L4	63	(a61m1/062 a61m1/066 a61m1/06).cpc. and	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2018/08/07 01:45 PM

		piezo$9	JPO)				
L5	19	("20040122358" | "20060226108" | "20080077042" | "20080167579" | "20120004603" | "3895533" | "4024856" | "4338953" | "5347656" | "5666104" | "5827191" | "7316653" | "7621797" | "7794425" | "8308648" | "8777864" | "8801658" | "8827911").PN. OR ("8992445").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/07 01:50 PM
L6	7	("5730139" | "6423010" | "6602199" | "7479154" | "8206414" | "8425426" | "8992445").PN. OR ("9192325").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/07 01:59 PM
L7	582	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:16 PM
L8	3369	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:58 PM
L9	2787	(a61m1/062 a61m1/066 a61m1/06).cpc. not L7	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:58 PM
L10	45	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/07 02:59 PM

		20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$).did. or (WO-2015174330-$ or WO-2016024558-$).did.					
L11	14	L10 and (pump$4 same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:59 PM
L12	2	"60479361".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/07 03:04 PM
L13	143	a61j13/00.cpc.	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/10 10:30 AM
L14	409	a61j13/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:30 AM
L15	3369	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:43 AM
L16	582	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L17	0	(a61m1/062 a61m1/066 a61m1/06).cpc. not (L16 L15)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L18	2665	(a61m1/062 a61m1/066 a61m1/06).cpc. not (L16 L14)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L19	71	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 11:47 AM

		US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$).did.					

L20	37	L19 and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 11:48 AM
L21	4	L19 and ((air with pump$4) same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 11:50 AM
L22	16	L19 and (pump$4 same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 12:15 PM
L23	1	L19 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 12:40 PM
L24	0	a61m1/1058.cpc. and breast and diaphragm	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 12:42 PM
L25	5	breast same pump$4 same piezo$8 same air	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 12:43 PM
L26	1	("9884172").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/10 01:58 PM
L27	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:40 AM
L28	2	"59563385".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:20 AM
L29	1	"59563425".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:20 AM
L30	87	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:26 AM

		20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$).did.					
L31	44	L30 and (air with	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/24

		pump$4)	USOCR; FPRS; EPO; JPO)				10:26 AM
L32	17	L30 and (pump$4 with diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 10:27 AM
L33	51	L27 and "air pump"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 11:07 AM
L34	4	"47900902".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 11:13 AM
L35	10	("20030212374" | "20050251089" | "20050283900" | "20070135778" | "20110054389" | "3084691" | "4229029" | "5295957" | "6070659").PN. OR ("9511176").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/24 11:16 AM
L36	2	"51149640".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 11:17 AM
L37	271	L27 and (control$4 same select$4 left same right same breast)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 12:50 PM
L38	3	L30 and (recharg$4 with battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 01:04 PM
L39	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:41 PM
L40	9	L39 and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:41 PM
L41	11	L39 and (light with milk with (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:48 PM
L42	0	L39 and (radiation with milk with (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:51 PM
L43	2	L39 and (radiation same milk same (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:51 PM
L44	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:13 PM
L45	10	L44 and ((piezo piezoelectric piezo-electric) same air same pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:13 PM
L46	1	a61m1/1058 and	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/24

		(suction$4 vacuum$4 aspirat$4)	USOCR; FPRS; EPO; JPO)				07:23 PM
L47	27	a61m1/1058.cpc. and (suction$4 vacuum$4 aspirat$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:23 PM
L48	23	L44 and (indicator same milk same (express$4 flow$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:26 PM
L49	51	L44 and (air same pressure same sens$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:30 PM
L50	19	L44 and ((indicat$4 record$4) same (right and left))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:38 PM
L51	56	L44 and (pump$4 with series)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:42 PM
L52	77	L44 and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:47 PM
L53	87	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 07:59 PM

		20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$).did.					
L54	44	L53 and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:59 PM
L55	5	L54 and (air with filter$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:59 PM

L56	3	L44 and (pump$4 with (db decibal?))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:07 PM
L57	6	L44 and ((db decibal?))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:07 PM
L58	26	L44 and (sens$4 with (orientation angle tilt placement))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:16 PM
L59	9	L44 and ((indicat$4 input$4 document$4 record$4) with comfort)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:31 PM
L60	484	a61m$/$.cpc. and ((indicat$4 input$4 document$4 record$4) with comfort)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:32 PM
L61	1	L44 and "social media"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:52 PM
L62	408	a61m$/$.cpc. and ((piezo piezoelectric piezo-electric) same air same pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:13 PM
L63	3606	a61m$/$.cpc. and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:18 PM
L64	359	a61m$/$.cpc. and ((pump$4 with weigh$4) same (portable lightweight carry$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:30 PM
L65	1	("20160166745").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/25 07:16 PM
L66	1	("20160058928").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/25 07:23 PM
L67	1	("20110004154").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/26 10:55 AM
L68	96	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/26 11:09 AM

		US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-					

		8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L69	2	L69 and (radiation same (height quantity amount volume))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/26 11:09 AM
L70	96	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/26 12:24 PM

		20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-					

		2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L71	3	L71 and ((diaphragm membrane) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/26 12:24 PM
L72	3606	a61m$/$.cpc. and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:09 PM
L73	137	L73 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:09 PM
L74	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:10 PM
L75	9	L75 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:10 PM
L76	19	L75 and (shield with snap$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:16 PM
L77	1	("20110152855").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 01:20 PM
L78	32	L75 and (flow with rate with air)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:33 PM
L79	3	L75 and (stall with pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:56 PM
L80	98	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/27 01:56 PM

		US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$).did. or (WO-2015174330-$ or					

		WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L81	17	L81 and (pressure same (mmhg kpa mbar pa bar))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:57 PM
L82	18	(("7550034") or ("8123502") or ("8297947") or ("8371829") or ("8409160") or ("8646479") or ("8734131") or ("8763633") or ("8821134") or ("9051931") or ("9127665") or ("9239059") or ("9279421") or ("9334858") or ("9506463") or ("9752565") or ("9709042") or ("9777851")).PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 02:08 PM
L83	0	L83 and breast	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:08 PM
L84	10	L83 and (lactat$3 milk)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:08 PM
L85	14	L81 and (piezo piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:10 PM
L86	5	L75 and ((piezo piezoelectric) with air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:47 PM
L87	230	(((piezo piezoelectric) with air with pump$4) same (miniature small compact lightweight))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:48 PM
L88	6	L88 and (breast milk lactat$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:53 PM

L89	161	a61m$/$.cpc. and ((piezo piezoelectric piezo-electric) with air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:11 PM
L90	0	(2017/0072118).CCLS.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:19 PM
L91	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:19 PM
L92	40	(((piezo piezoelectric) with air with pump$4) same (miniature small compact lightweight)) same (vacuum$4 suction$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:22 PM
L93	3	"45513973".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/27 03:23 PM
L94	364	(((piezo piezoelectric) with pump$4) same (miniature small compact lightweight)) same (vacuum$4 suction$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:32 PM
L95	3	"20170035951"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:33 PM
L96	1	L96 and (suction$4 with piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:34 PM
L97	1	("20130064683").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:38 PM
L98	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:39 PM
L99	1	(US-20170172485-$).did.	(US-PGPUB)	OR	OFF	OFF	2018/08/28 04:48 PM
L100	0	L100 and "function of"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 04:48 PM
L101	100	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/28 05:19 PM

		US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-					

		7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L102	0	L102 and ((meaur$4 with milk) same rate)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:20 PM
L103	0	L102 and ((meaur$4 with milk) same (frequency speed))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:20 PM
L104	16	L102 and ((measur$4 with milk) same (frequency speed rate))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:21 PM
L105	0	L102 and ((measur$4 with milk) with "function of")	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:23 PM
L106	6	L102 and (decrease with (rate speed frequency strong))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:10 PM
L107	2	L102 and (latch$4 with adjust$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:22 PM
L108	50	(a61m$/$).cpc. and (wear$4 with pump$4) and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:24 PM
L109	0	(a61m$/$).cpc. and (wear$4 with pump$4) and (((center centre) with gravity) same comfort$5)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:25 PM
L110	83	(a61m$/$).cpc. and (((center centre) with gravity) same	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:26 PM

		comfort$5)					
L111	101	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 09:43 AM

		US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L112	3	L112 and (shield with (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:43 AM
L113	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:47 AM
L114	86	L114 and ((diapragm housing) with (housing case mount$4) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:53 AM
L115	9	L114 and ((diapragm membrane) with (housing case mount$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:54 AM

		with shield)					
L116	34	L112 and (diaphragm membrane)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:07 AM
L117	28	L114 and (diaphragm membrane) and (shield with dispos$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:10 AM
L118	28	L114 and ((diaphragm membrane) with (coupl$4 attach$4 mount$4) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:23 AM
L119	0	a61j16/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:41 AM
L120	409	a61j13/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:42 AM
L121	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:23 PM
L122	23	L122 and (sens$4 same (orient$4 plac$4 situat$4) same (nipple shield))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:23 PM
L123	11	L122 and ((sens$4 accelerometer) with breast with (move moved moving movement))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:32 PM
L124	10	L122 and accelerometer	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:33 PM
L125	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 02:27 PM
L126	259	L122 and ((lower$4 decrea$4) with (suction$4 intens$4 pain comfort discomfort))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 02:51 PM
L127	45	L122 and ((lower$4 decrea$4) with (intens$4 pain comfort discomfort))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 02:59 PM
L128	11	(a61m$/$.cpc.) and ((miniature compact small) same (piezoelectric piezo-electric piezo) same pump$4 same (suction$4 vacuum$4) same (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 03:40 PM
L129	127	L122 and ((pressure	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/29

		suction$4) with (mmhg kpa mbar pa bar))	USOCR; FPRS; EPO; JPO)				05:16 PM
L130	2	"60479361".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 05:29 PM
L131	106	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 05:31 PM

		20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L132	104	L132 and @ad<="20170615"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 05:32 PM
L133	14	(US-20160166745-$ or	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/29

		US-20150283311-$ or US-20180110906-$ or US-20140378895-$ or US-20140031744-$ or US-20160220743-$ or US-20160256617-$ or US-20080177224-$ or US-20130023821-$ or US-20160058928-$ or US-20170043065-$ or US-20110004154-$).did. or (US-10039871-$ or US-6358226-$).did.					06:08 PM
L134	1	"52574056".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 06:46 PM
L135	0	("2009024080").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 06:53 PM
L136	1	("20090024080").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 06:53 PM
L137	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 07:30 PM
L138	203	L138 and ((shield nipple) with (remov$4 replac$4 clean$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 07:30 PM
L139	1	("4535627").PN.	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/01/08 12:52 PM
L140	74	(("20180361040") or ("20180236147") or ("20120277728") or ("7785305") or ("20080208116") or ("7223255") or ("7789865") or ("8118772") or ("20080275385") or ("9956331") or ("8057425") or ("20070219486") or ("20020193731") or ("10046097") or ("20140378946") or ("20180326130") or ("20120316493") or ("8568350") or ("20030191427") or ("8070716") or ("9539377") or ("20160303298") or ("20160206794") or ("9539376") or ("20160310649") or ("20160287769") or ("20160310650") or ("20180001002") or	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/01/08 12:54 PM

		("20090099511") or ("7776008") or ("20090062731") or ("20160296682") or ("20050154349") or ("20030191433") or ("5749850") or ("20100292636") or ("7559915") or ("20080262420") or ("20160325031") or ("20170173232") or ("7749188") or ("6887217") or ("6139521") or ("20180021490") or ("20150065994") or ("20180028732") or ("20150196460") or ("9636282") or ("7758540") or ("8945046") or ("20080243059") or ("20110251552") or ("20170119942") or ("20130023821") or ("6997897") or ("9033913") or ("20150157776") or ("20090254028") or ("5514166") or ("20010038799") or ("20070161947") or ("20130046234") or ("8926556") or ("7255681") or ("7008400") or ("6257847") or ("20100145264") or ("20170151380") or ("20070078383") or ("5542921") or ("20180333523") or ("8075516") or ("20180369464") or ("20110071466")).PN.					
L141	111	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-2012004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2019/01/08 01:02 PM

		US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or					

		US-20180333523-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L142	35	L142 and (heavy weight "center of gravity" "centre of gravity" mass)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:03 PM
L143	3497	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:22 PM
L144	284	L144 and (heavy weight "center of gravity" "centre of gravity")	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:22 PM
L145	3497	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 04:06 PM
L146	18	L146 and (weight with distribut$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2019/01/08 04:06 PM

			JPO)				
L147	1	("4535627").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/03/14 02:19 PM
L148	112	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2019/04/16 03:00 PM

		(US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					

L149	21	L149 and (pump$4 with (lightweight mass weight heavy))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 03:00 PM
L150	94	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (weight lightweight))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 03:14 PM
L151	47	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (mass heavy))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 05:04 PM
L152	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (mass heavy)) not L151	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 05:04 PM
L153	1	("20110274566").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/04/19 01:51 PM
L154	1	("20110274566").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/09 12:52 PM
L155	57	(breast with pump) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:04 AM
L156	1	(16/009547).APP.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/15 09:08 AM
L157	1	L157 and (pressure same noise)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:08 AM
L158	635	((piezo piezoelectric) with pump) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:10 AM
L159	1	L157 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:16 AM
L160	26	(breast with pump) and (mmhg and noise)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:24 AM
L161	1	L157 and (liter litre)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:30 AM
L162	1	((piezo piezoelectric) with pump) and "YIP Ventus"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:33 AM
L163	19	(("7550034") or ("8123502") or ("8297947") or ("8371829") or ("8409160") or ("8646479") or ("8734131") or ("8763633") or	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/15 09:36 AM

		("8821134") or ("9051931") or ("9127665") or ("9234518") or ("9239059") or ("9279421") or ("9334858") or ("9506463") or ("9752565") or ("9709042") or ("9777851")).PN.					
L164	5	L164 and (mmhg mbar kpa)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:36 AM
L165	0	L164 and (litre liter)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L166	2	L164 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L167	17	L164 and (piezo piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L168	1	L164 and (piezo piezoelectric) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:38 AM
L169	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:50 AM
L170	1	L170 and gravity	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:50 AM
L171	1	L170 and (gravity same nipple)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:51 AM
L172	61	(breast with pump$4) and ((centre center) with container)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:55 AM
L173	1	L170 and (gravity same container)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:55 AM
L174	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 11:54 AM
L175	1	L176 and (high height)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 11:54 AM
L176	25	(breast with pump$4) and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 12:55 PM
L177	113	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2020/01/09 03:02 PM

		US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or					

		US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$ or US-20180361040-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L178	30	L179 and noise	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 03:02 PM
L179	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2020/01/13 01:45 PM

			JPO)				
L180	1	L181 and gravity	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:45 PM
L181	1	L181 and length	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:46 PM
L182	1	L181 and height	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:48 PM
L183	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:29 PM
L184	1	L185 and "half-way"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:29 PM
L185	113	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2020/01/14 02:36 PM

		20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$ or US-20180361040-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or					

		WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L186	3	L187 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:37 PM
L187	2	L187 and (top with heavy)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:37 PM
L188	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:06 AM
L189	1	L190 and (weight mass)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:06 AM
L190	1	L190 and (housing same battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:07 AM
L191	1	L190 and (shield same (mold$4 mould$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:08 AM
L192	1	L190 and (diaphragm same seal$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:09 AM
L193	0	L190 and (diaphragm same tunnel same flange)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L194	0	L190 and (diaphragm same spaced)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L195	0	L190 and (diaphragm same surround)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L196	1	verhoef.inv. and dog and figure	(US-PGPUB)	OR	OFF	OFF	2020/01/15 01:27 PM
L197	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:28 PM
L198	1	L199 and (shield with single)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:28 PM

L199	67	(a61m$/$).cpc. and (wear$4 with pump$4) and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L200	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L201	1	L202 and (shield with single)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L202	1	L202 and (shield with piece)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:33 PM
L203	0	L202 and ((housing diagraphm) with spac$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:18 PM
L204	1	L202 and (shield with housing with diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:19 PM
L205	1	L202 and ((housing diaphragm) with spac$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:19 PM
L206	143	(breast with pump) and (piezo piezoelectric) and (membrane diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 11:42 AM
L207	78	("20030191433" | "20040024351" | "20040101414" | "20050059928" | "20050131332" | "20050234370" | "20060106334" | "20080045888" | "20080177224" | "20080243059" | "20090024080" | "20100010682" | "20100106082" | "20100217148" | "20110071466" | "20110196291" | "20110245763" | "20110270162" | "20120101575" | "20120277728" | "20130023821" | "20130123688" | "20130131588" | "20130177455" | "20140066734" | "20140378895" | "20140378946" | "20150065994" | "20150100016" |	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2020/09/28 12:42 PM

		"20150148709" | "20150196247" | "20150292500" | "20160015876" | "20160256618" | "20160287769" | "20170072118" | "20170080134" | "20170173232" | "4263912" | "4311141" | "4768547" | "4821580" | "5542921" | "5634468" | "5658133" | "5810772" | "5827191" | "6273868" | "6287252" | "6328082" | "6440100" | "6547756" | "6579258" | "6712785" | "6840918" | "7201735" | "7223255" | "7621797" | "7824363" | "7972297" | "7988661" | "8057425" | "8070715" | "8070716" | "8262606" | "8282596" | "8353865" | "8357116" | "8376986" | "8671701" | "8684961" | "8801495" | "9050404" | "9162016" | "9173587" | "9199017" | "9278167" | "D459233").PN. OR ("10625005").URPN.					
L208	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 02:57 PM
L209	1	L210 and 19a	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 02:57 PM
L210	132289	"201" and recess	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:02 PM
L211	0	L210 and recess	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:02 PM
L212	645454	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:06 PM
L213	574	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:06 PM
L214	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/29 09:51 AM
L215	1	L216 and flat	(US-PGPUB; USPAT;	OR	OFF	OFF	2020/09/29

			USOCR; FPRS; EPO; JPO)				09:51 AM
L216	57377	breast.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L217	398558	pump$4.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L218	92405	(piezo piezoelectric).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L219	72010	diaphragm.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L220	26553	(db decibal).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L221	27368	(db decibal).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L222	2	L218 and L219 and L220 and L221	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L223	2	L218 and L219 and L220 and L224	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L226	32	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((usb "universal serial bus") WITH (charg$4 recharg$4 power$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 12:16 PM
L227	0	214 AND (usb SAME socket)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:25 PM
L228	2	214 AND socket	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:25 PM
L229	2	"61007742".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; JPO)	OR	ON	ON	2021/05/18 12:34 PM

L230	7	"2015069095".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:38 PM
L231	122	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/18 01:00 PM

		20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1					

		OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L232	18	231 AND recharg$5	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:00 PM
L233	2	214 AND (rigid SAME	(US-PGPUB; USPAT;	OR	ON	ON	2021/05/18

		shield)	USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				01:05 PM
L234	27173	a61m5/14244,14248.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:42 PM
L235	555	234 AND ((power$4 batter$4) WITH (charg$5 recharg$5) WITH (usb "universal serial bus"))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:42 PM
L236	82	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND bra AND wireless$4 AND (control$4 processor electronic$4) AND (power$4 battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 01:53 PM
L237	82	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND bra AND wireless$4 AND (control$4 processor electronic$4) AND (power$4 batter$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 01:53 PM
L238	14	231 AND ((charg$5 recharg$5) WITH (power$4 batter$4)) AND wireless$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 03:59 PM
L239	2	"20140275857".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 04:48 PM
L240	12	231 AND (rigid WITH (bottle container))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/05/18 04:52 PM

			AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L241	2	214 AND (shield WITH (flexible silicon$4 material soft rubber))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 05:35 PM
L242	2	231 AND (rigid WITH shield)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 05:38 PM
L243	128	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/20 03:05 PM

		US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-					

		A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-2016058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-					

		2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L244	8	243 AND ((membrane diaphragm) SAME shield)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/20 03:06 PM
L245	88	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH rigid)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:09 PM
L246	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH (plastic rigid) WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:13 PM
L247	7	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:13 PM
L248	68	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (rigid WITH polypropylene)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:14 PM
L249	25	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container) WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:17 PM
L250	19	243 AND ((bottle container) WITH (rigid polypropylene plastic))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:23 PM
L251	21	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container) WITH magnet$6)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:49 PM
L252	2	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:57 PM

		((shield nipple flange) WITH guide WITH line)					
L253	207	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield nipple flange) WITH line)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:57 PM
L254	5	"6328709".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/20 05:59 PM
L255	91	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (nipple WITH line)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 06:00 PM
L256	130	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/21 12:39 PM

		20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1					

		OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-					

		2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L257	1	256 AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 12:39 PM
L258	6	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:40 PM
L259	6	(breast WITH pump$4) AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:41 PM
L260	73	(breast WITH pump$4) AND ((bottle container milk) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:41 PM
L261	11	(breast WITH pump$4) AND ((bottle container milk bag) WITH (polycarbonate tritan)) AND ((bottle container milk storage bag) WITH (clear transparent "see through" see-through))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:45 PM
L262	55	(breast WITH pump$4) AND ((bottle container milk bag) WITH (magnet$6))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 01:09 PM
L263	182	(breast WITH pump$4) AND ((shield flange) WITH (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 01:26 PM
L264	132	((US-6440100-B1 OR US-6547756-B1 OR	(USPAT; US-PGPUB; FPRS; USOCR;	OR	ON	ON	2021/05/21 01:26 PM

		US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1	IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))				

		OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-					

		20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L265	9	264 AND (clear transparent) WITH (container bottle bag)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/05/21 01:27 PM

			IBM_TDB)				
L266	4	264 AND (polycarbonate) WITH (container bottle bag)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 01:27 PM
L267	6	(breast WITH pump$4) AND ((bottle container milk) WITH (polycarbonate tritan)) AND ((bottle container milk) WITH dishwash$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 02:28 PM
L268	34	264 AND ((alert$4 indicat$4 light) WITH (milk))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 03:46 PM
L269	19	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH start$4 WITH stop$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:36 PM
L270	21	264 AND (milk WITH (indicat$4 alert$4 display$4) WITH (flow$4 volume))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:39 PM
L271	20	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH threshold)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:55 PM
L272	95	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH (predetermin$4 limit level))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:58 PM
L273	38	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH (predetermin$4 limit level) WITH (increas$4 decreas$4 chang$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:58 PM
L274	4	(a61m1/062 a61m1/066	(US-PGPUB; USPAT;	OR	OFF	OFF	2021/05/21

		a61m1/06 a41c4/04 a61j13/00).cpc. AND (pump$4 WITH alert$4 WITH (correct$4))	USOCR; FPRS; EPO; JPO)				05:00 PM
L275	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (operat$4 WITH alert$4 WITH (correct$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:00 PM
L276	9	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (alert$4 WITH (correct$4 proper$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:00 PM
L277	23	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH rotat$4 WITH position$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:44 PM
L278	62	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH slid$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:03 PM
L279	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH slid$4 WITH (attach$4 coupl$4 connect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:04 PM
L280	71	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH thread$4 WITH (attach$4 coupl$4 connect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:06 PM
L281	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((clean$4 disinfect$4 sanitiz$4) WITH (shield flange) WITH (container bottle bag))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:20 PM
L282	111	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (diaphragm WITH (housing holder))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:44 PM
L283	2	"20120277728".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/05/21 06:46 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L284	7	264 AND (light WITH emit$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 06:55 PM
L285	11	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (db decibel)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:12 PM
L286	77	(breast WITH pump$4) AND (db decibel)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:17 PM
L287	75	willow AND (breast WITH pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:26 PM
L288	20047	(a61m a61b).cpcl. AND (pump$ wth piezo piezoelectric) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L289	9898	(a61m a61b).cpcl. AND (pump$ WITH piezo piezoelectric) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L290	892	(a61m a61b).cpcl. AND (pump$ WITH piezo piezoelectric) SAME (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L291	892	(a61m a61b).cpcl. AND (pump$4 WITH piezo piezoelectric) SAME (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L292	24	(a61m a61b).cpcl. AND (pump$4 WITH (piezo	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/05/21 07:33 PM

		piezoelectric)) SAME (decibel db)	AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L293	654	(a61m a61b).cpcl. AND (pump$4 WITH (piezo piezoelectric)) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:34 PM
L294	337	(a61m a61b).cpcl. AND (pump$4 WITH (piezo piezoelectric)) AND (decibel db)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/05/21 07:34 PM
L295	138	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/22 09:07 AM

		US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-					

		A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-					

		2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L296	13	295 AND (bar mbar kpa) AND "flow rate"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 09:07 AM
L297	2	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (pressure WITH kpa mmhg mbar bar) AND ((air vacuum$4 suction$4) WITH l/min)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/22 09:21 AM
L298	157	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (pressure WITH (kpa mmhg mbar bar))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/22 09:23 AM
L299	2	16/009547.app. AND (mechanism SAME container SAME housing)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L300	2	16/009547.app. AND (mechanism WITH container WITH housing)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/05/22 10:47 AM

			JPO; DERWENT; IBM_TDB)				
L301	40	295 AND magnet$6	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:50 AM
L302	6	295 AND (magnet$6 WITH (container bag bottle))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:51 AM
L303	599	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/24 12:04 PM
L304	7	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/24 02:33 PM
L305	140	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/02 03:38 PM

		OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-					

		20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1					

		OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L306	2	140 AND piezo	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:38 PM
L307	14	140 AND piezo$8	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:38 PM
L308	32	305 AND piezo$8	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/06/02 03:39 PM

			JPO; DERWENT; IBM_TDB)				
L309	6	305 AND piezo$8 AND parallel	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:41 PM
L310	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((container milk bottle) WITH (angle tilt$4) WITH (sens$4 detect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:47 PM
L311	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH right WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:54 PM
L312	78	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (which WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L313	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L314	10	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH sens$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L315	11	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH select$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:59 PM
L316	33	305 AND (maximum WITH (suction$4 vacuum$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 04:02 PM
L317	16	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((icon button) WITH start$4 WITH (stop$4	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:06 PM

		paus$4))					
L318	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH tritan)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:08 PM
L319	3	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH (transparent clear)) AND ((shield flange) WITH polycarbonate)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:08 PM
L321	195	((milk lactat$4 breast) WITH pump$4) AND ((shield flange) WITH magnet$6)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/14 01:25 PM
L322	4	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH (transparent clear)) AND ((shield flange) WITH (tritan polycarbonate))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/15 12:15 PM
L323	250	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) SAME (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/15 01:51 PM
L324	19	("7550034," "8123502," "8297947," "8371829," "8409160," "8646479," "8734131," "8763633," "8821134," "9051931," "9127665," "9234518," "9239059," "9279421," "9334858," "9506463," "9752565," "9709042," "9777851").pn.	(USPAT)	OR	ON	ON	2021/06/16 12:28 PM
L325	9	324 AND stall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 12:28 PM
L326	19	"stall pressure" WITH (aspirat$4 vacuum$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/06/16 12:35 PM

		suction$4)	AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L327	4184	(stall WITH pressure WITH pump$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 12:39 PM
L328	3	324 AND mbar	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 01:42 PM
L329	50	(ttp WITH ventus)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 01:54 PM
L330	3	(ttp WITH ventus)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/06/16 01:54 PM
L331	252	(ventus)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/06/16 01:55 PM
L332	36	((stall WITH pressure WITH pump$4) SAME piezo$10)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 02:28 PM
L333	18	324 AND maximum	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 02:35 PM
L334	52	pump$4 WITH stall WITH piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/06/16 02:38 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L335	220	(breast SAME pump$4 SAME piezo$10)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 03:17 PM
L336	79	(breast WITH pump$4) AND (pressure WITH (stall$4 crack$4 occlusion break$4 block$4) WITH (mmhg kpa mbar bar pa))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 03:35 PM
L337	68	ventus AND piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:11 PM
L338	11	337 AND stall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:12 PM
L339	11	337 AND (mmhg mbar kpa)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:13 PM
L340	0	324 AND l/min	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:43 PM
L341	11	324 AND (air WITH flow$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/06/19 03:43 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L342	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/19 03:48 PM

		A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR					

		US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR					

		WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L343	1	342 AND "l/min"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:49 PM
L344	6	324 AND (free WITH flow)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:49 PM
L345	2	("10881766").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 06:28 PM
L346	2	("10926011").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD,	OR	ON	ON	2021/06/19 06:44 PM

			DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L347	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/19 09:14 PM

		US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-					

		A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR					

		CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L348	39	347 AND piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:14 PM
L349	28	347 AND piezo$10 AND breast	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:14 PM
L350	2	"10881766".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:39 PM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

U.S.PATENTS

Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2849881	A	1958-09-02	ANDERSON	
	2	4390024	A	1983-06-28	WILLIAMS	
	3	4535627	A	1985-08-20	PROST, et al.	
	4	5474683	A	1995-12-12	BRYANT, et al.	
	5	5941847	A	1999-08-24	HUBER, et al.	
	6	5973770	A	1999-10-26	CARTER, et al.	
	7	6045529	A	2000-04-04	NUEESCH	
	8	6090065	A	2000-07-18	GILES	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	9	6227936	B1	2001-05-08	MENDOZA	
	10	6328709	B1	2001-12-11	HUNG, et al.	
	11	6358226	B1	2002-03-19	RYAN	
	12	6383163	B1	2002-05-07	KELLY, et al.	
	13	6440100	B1	2002-08-27	PRENTISS	
	14	6461324	B1	2002-10-08	SCHLENSOG	
	15	6547756	B1	2003-04-15	GRETER, et al.	
	16	6579258	B1	2003-06-17	ATKIN, et al.	
	17	6663587	B2	2003-12-16	SILVER, et al.	
	18	6749582	B2	2004-06-15	BRITTO, et al.	
	19	7048519	B2	2006-05-23	FONG, et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	20	7201735	B2	2007-04-10	ATKIN, et al.	
	21	D548831	S	2007-08-14	CHARLEZ	
	22	7312554	B2	2007-12-25	VOGELEY	
	23	7314400	B2	2008-01-01	FILDAN, et al.	
	24	7662018	B1	2010-02-16	THOMPSON	
	25	7776008	B2	2010-08-17	RENZ, et al.	
	26	8057425	B1	2011-11-15	MYERS, et al.	
	27	8118772	B2	2012-02-21	DAO, et al.	
	28	8187227	B2	2012-05-29	LUZBETAK, et al.	
	29	8262606	B2	2012-09-11	GRETER, et al.	
	30	8282596	B2	2012-10-09	GRETER, et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	31	8376986	B2	2013-02-19	VAN, et al.	
	32	8702646	B2	2014-04-22	GARBEZ, et al.	
	33	8801495	B1	2014-08-12	GUINDON	
	34	8876760	B2	2014-11-04	BOSMAN, et al.	
	35	8926556	B2	2015-01-06	VAN EIJKELENBORG, et al.	
	36	9033913	B2	2015-05-19	KHALIL, et al.	
	37	9173587	B2	2015-11-03	VAN SCHIJNDEL, et al.	
	38	9345274	B1	2016-05-24	PRILL	
	39	9539377	B2	2017-01-10	MAKOWER, et al.	
	40	10039871	B2	2018-08-07	POLLEN, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020193731	A1	2002-12-19	MYERS, et al.	
	2	20040056641	A1	2004-03-25	MYERS, et al.	
	3	20040074281	A1	2004-04-22	LOBDELL, et al.	
	4	20040267215	A1	2004-12-30	CHARLEZ, et al.	
	5	20050219302	A1	2005-10-06	VOGELEY, et al.	
	6	20060122575	A1	2006-06-08	WAKABAYASHI	
	7	20070051172	A1	2007-03-08	PERINET, et al.	
	8	20070051727	A1	2007-03-08	HOLLEY	
	9	20080177224	A1	2008-07-24	KELLY, et al.	
	10	20080262420	A1	2008-10-23	DAO, et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	11	20080275386	A1	2008-11-06	MYERS	
	12	20110004154	A1	2011-01-06	VAN, et al.	
	13	20110196291	A1	2011-08-11	VISCHER, et al.	
	14	20110274566	A1	2011-11-10	AMIROUCHE, et al.	
	15	20120277636	A1	2012-11-01	BLONDHEIM, et al.	
	16	20130023821	A1	2013-01-24	KHALIL, et al.	
	17	20140031744	A1	2014-01-30	CHEN	
	18	20140052056	A1	2014-02-20	GARBEZ, et al.	
	19	20140275857	A1	2014-09-18	TOTH, et al.	
	20	20140323962	A1	2014-10-30	KOOIJKER, et al.	
	21	20140378895	A1	2014-12-25	BARACK	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	22	20150217036	A1	2015-08-06	POLLEN, et al.	
	23	20150217037	A1	2015-08-06	POLLEN, et al.	
	24	20150283311	A1	2015-10-08	ALVAREZ, et al.	
	25	20160000980	A1	2016-01-07	ALVAREZ, et al.	
	26	20160058928	A1	2016-03-03	NOWROOZI, et al.	
	27	20160058929	A1	2016-03-03	MEDVEDEV, et al.	
	28	20160082165	A1	2016-03-24	ALVAREZ, et al.	
	29	20160082166	A1	2016-03-24	GUTHRIE, et al.	
	30	20160151551	A1	2016-06-02	FELBER	
	31	20160158424	A1	2016-06-09	CHEN, et al.	
	32	20160166745	A1	2016-06-16	AALDERS	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	33	20160206794	A1	2016-07-21	MAKOWER, et al.	
	34	20160220743	A1	2016-08-04	GUTHRIE, et al.	
	35	20160220745	A1	2016-08-04	GUTHRIE, et al.	
	36	20160256617	A1	2016-09-08	HANSEN	
	37	20160271305	A1	2016-09-22	KURIHARA, et al.	
	38	20160287767	A1	2016-10-06	SIMMONS, et al.	
	39	20160296681	A1	2016-10-13	GASKIN, et al.	
	40	20160310650	A1	2016-10-27	MAKOWER, et al.	
	41	20170021068	A1	2017-01-26	GASKIN, et al.	
	42	20170035951	A1	2017-02-09	TANAKA	
	43	20170043065	A1	2017-02-16	TAKEUCHI	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	44	20170072117	A1	2017-03-16	KURIHARA, et al.	
	45	20170072118	A1	2017-03-16	MAKOWER, et al.	
	46	20170095599	A1	2017-04-06	KONDO, et al.	
	47	20170143879	A1	2017-05-25	OKAGUCHI	
	48	20170220753	A1	2017-08-03	GUTHRIE, et al.	
	49	20180021490	A1	2018-01-25	CHANG, et al.	
	50	20180110906	A1	2018-04-26	BARACK	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	3311982	DE	C2	1983-10-13	BATTELLE MEMORIAL INSTITUTE		
	2	9503280	EP	A2	1992-02-08	PIERBURG GMBH		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	3		9420158	WO	A1	1994-09-15	DEKA PRODUCTS LIMITED PARTNERSHIP		
	4		19750620	DE	A1	1999-06-02	SIEMENS AG, 80333 MUENCHEN, DE		
	5		1586340	EP	A2	2005-10-19	SEA PROFIT (HONG KONG) LIMITED		
	6		2005114116	WO	A1	2005-12-01	LANE, JOHN, DENNIS; ESPARZA, JOSEPH, LUIS; NICHOLS		
	7		2005114113	WO	A3	2006-03-02	ACCU-GAUGE LIMITED		
	8		1430918	EP	B1	2008-05-14	MEDELA HOLDING AG		
	9		2344380	RU	C1	2009-01-20	GOSUDARSTVENNOE OBRAZOVATEL'NOE UCHREZHDENIE VYSSH		
	10		2009134271	WO	A1	2009-11-05	UTC POWER CORPORATION		
	11		2473022	GB	B	2011-12-14			
	12		2441367	RU	C2	2012-02-10	OBSHCHESTVO S OGRANICHENNOJ OTVETSTVENNOST'JU 'NAU		
	13		2436277	EP	A1	2012-04-04	DREW, LORNA		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	14	2210628	EP	B1	2013-02-13	MEDELA HOLDING AG		
	15	2499248	GB	B	2014-04-02	ELIZABETH MORANA		
	16	1404393	EP	B1	2014-12-24	MEDELA HOLDING AG		
	17	2015081459	WO	A1	2015-06-11	CHEN, JUNBO		
	18	2015116749	WO	A1	2015-08-06	CORNING INCORPORATED		
	19	2015120321	WO	A1	2015-08-13	NAIA HEALTH, INC.		
	20	2015150225	WO	A1	2015-10-08	KONINKLIJKE PHILIPS N.V.		
	21	2015174330	WO	A1	2015-11-19	MURATA MANUFACTURING CO., LTD.		
	22	2016002606	WO	A1	2016-01-07	MURATA MANUFACTURING CO., LTD.		
	23	2016006494	WO	A1	2016-01-14	MURATA MANUFACTURING CO., LTD.		
	24	2016006496	WO	A1	2016-01-14	MURATA MANUFACTURING CO., LTD.		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	25	2016007560	WO	A1	2016-01-14	NAYA HEALTH, INC.		
	26	2016010524	JP	A	2016-01-21	MURATA MFG CO LTD		
	27	2016014469	WO	A1	2016-01-28	EXPLORAMED NC7, LLC		
	28	2016014488	WO	A1	2016-01-28	EXPLORAMED NC7, LLC		
	29	105288759	CN	A	2016-02-03	SHANGHAI NORMAL UNIVERSITY		
	30	2016024558	WO	A1	2016-02-18	MURATA MANUFACTURING CO., LTD.		
	31	2016039083	WO	A1	2016-03-17	MURATA MANUFACTURING CO., LTD.		
	32	2016104673	WO	A1	2016-06-30	MURATA MANUFACTURING CO., LTD.		
	33	2077868	EP	B1	2016-07-27	MEDELA HOLDING AG		
	34	2016164853	WO	A1	2016-10-13	NAYA HEALTH, INC.		
	35	1263487	EP	B2	2016-11-23	MEDELA HOLDING AG		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

	36	2017061349	WO	A1	2017-04-13	MURATA MANUFACTURING CO., LTD.		
	37	2017108555	WO	A1	2017-06-29	KONINKLIJKE PHILIPS N.V.		
	38	2017139480	WO	A1	2017-08-17	EXPLORAMED NC7, INC.		

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Whisper Wear Hands-Free Breast Pump, Model: WWPMP01, User Guide, pps. 1-20, Distributed with product at least as early as 2007 (see https://web.archive.org/web/20070621162539/http://www.whisperwear.com/pump_single.html)	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/COURTNEY B FREDRICKSON/	Date Considered	06/19/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	
	Filing Date	
	First Named Inventor	Jonathan O'Toole
	Art Unit	
	Examiner Name	
	Attorney Docket Number	373499.00050

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

✓ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark D. Simpson/	Date (YYYY-MM-DD)	2021-03-16
Name/Print	Mark D Simpson	Registration Number	32942

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/203,050	03/16/2021	Jonathan O'TOOLE	373499.00050

CONFIRMATION NO. 9649

PUBLICATION NOTICE

OC000000126696575

78905
Saul Ewing Arnstein & Lehr LLP (Philadelphia)
Attn: Patent Docket Clerk
Centre Square West
1500 Market Street, 38th Floor
Philadelphia, PA 19102-2186

Title:BREAST PUMP SYSTEM

Publication No.US-2021-0196873-A1
Publication Date:07/01/2021

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	17203050
Filing Date	2021-03-16
First Named Inventor	Jonathan O'Toole
Art Unit	3783
Examiner Name	C. Fredrickson
Attorney Docket Number	373499.00050

U.S.PATENTS

Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5542921	A	1996-08-06	MEYERS, et al.	
	2	7833190	B1	2010-11-16	HALL	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS

Remove

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20070135761	A1	2007-06-14	CHENG, et al.	
	2	20170112983	A1	2017-04-27	THORNE, et al.	
	3	20180333523	A1	2018-11-22	CHANG, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS

Remove

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	17203050
	Filing Date	2021-03-16
	First Named Inventor	Jonathan O'Toole
	Art Unit	3783
	Examiner Name	C. Fredrickson
	Attorney Docket Number	373499.00050

	1						

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	17203050
	Filing Date	2021-03-16
	First Named Inventor	Jonathan O'Toole
	Art Unit	3783
	Examiner Name	C. Fredrickson
	Attorney Docket Number	373499.00050

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

✓ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

✓ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark D. Simpson/	Date (YYYY-MM-DD)	2021-09-05
Name/Print	Mark D. Simpson	Registration Number	32942

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	43688915
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	78905
Filer:	Mark D. Simpson/Lynn White
Filer Authorized By:	Mark D. Simpson
Attorney Docket Number:	373499.00050
Receipt Date:	05-SEP-2021
Filing Date:	16-MAR-2021
Time Stamp:	19:43:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	38945168_1.PDF	1036979 071c62a1e1809bac83cd1e26648745d2bd0cc33d	no	4

Warnings:

Information:	
Total Files Size (in bytes):	1036979

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	17/203,050
Filing Date	March 16, 2021
First Named Inventor	Jonathan O'TOOLE
Title	BREAST PUMP SYSTEM
Art Unit	3783
Examiner Name	Courtney B. Fredrickson
Attorney Docket Number	ELVI-002/07US

SIGNATURE of Applicant or Patent Practitioner

Signature	/Kassity L. Mai/	Date (Optional)	September 16, 2021
Name	Kassity L. Mai	Registration Number	68,774
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of 1 forms are submitted.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

[X] I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 58249

OR

[ ] I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

[X] The address associated with the above-mentioned Customer Number

OR

[ ] The address associated with Customer Number:

OR

[ ] Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Chiaro Technology Limited

[ ] Inventor or Joint Inventor (title not required below)

[ ] Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

[X] Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

[ ] Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	Hannah Brunskill	Date (Optional)	September 13, 2021
Name	Hannah Brunskill		
Title	Head of Legal		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

[X] Total of 1 forms are submitted.

Electronic Acknowledgement Receipt

EFS ID:	43786800
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	78905
Filer:	Kassity L. Mai/Julie Chandler
Filer Authorized By:	Kassity L. Mai
Attorney Docket Number:	373499.00050
Receipt Date:	16-SEP-2021
Filing Date:	16-MAR-2021
Time Stamp:	16:53:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	ELVI_002_07US_Power_Of_Attorney.pdf	118946 6d19dfabbbbfad0cd47aa552282e7351d76bd3fc	no	2

Warnings:

Information:	
Total Files Size (in bytes):	118946

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/203,050	03/16/2021	Jonathan O'TOOLE	373499.00050

CONFIRMATION NO. 9649

POWER OF ATTORNEY NOTICE

OC000000128526522

78905
Saul Ewing Arnstein & Lehr LLP (Philadelphia)
Attn: Patent Docket Clerk
Centre Square West
1500 Market Street, 38th Floor
Philadelphia, PA 19102-2186

Date Mailed: 09/21/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/16/2021.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rmohamed/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US

CONFIRMATION NO. 9649

POA ACCEPTANCE LETTER

OC000000128526618

58249
COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue, NW
Suite 700
Washington, DC 20004

Date Mailed: 09/21/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/16/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rmohamed/

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 17/203,050	Filing Date 03/16/2021	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)			
FOR	NUMBER FILED	NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $240 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	09/24/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 30	Minus	** 30	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/DIANIECE M JACOBS/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

Docket No.: ELVI-002/07US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Jonathan O'TOOLE	Confirmation No.:	9649
Application No.:	17/203,050	Group Art Unit:	3783
Filed:	March 16, 2021	Examiner:	Courtney B. Fredrickson

For: BREAST PUMP SYSTEM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT/RESPONSE TO OFFICE ACTION

In response to the non-final Office Action dated June 24, 2021, to which the deadline for responding is September 24, 2021, Applicant submits the following Amendments and/or Remarks, and respectfully requests reconsideration of the application in view thereof.

Any extensions of time necessary to prevent abandonment of this application are hereby petitioned for under 37 C.F.R. §1.136(a), and any additional fees required (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 50-1283.

Amendments to the Claims are reflected in the listing of the claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 7 of this paper.

IN THE CLAIMS:

Set forth below in ascending order, with status identifiers, is a complete listing of all claims currently under examination. Changes to any amended claims are indicated by [[double brackets]], ~~strikethrough~~ and/or underlining. This listing also reflects any cancellation and/or addition of claims.

1. (Currently Amended) A breast pump device that is configured as a self-contained, in-bra wearable device, the breast pump device comprising ~~and that includes~~:

(i) a housing that includes (a) a ~~rechargeable~~ battery, ~~; (b) a power charging circuit for controlling the charging of the rechargeable battery; (c) control electronics powered by the rechargeable battery;~~ and (b) [[(d)]] a pump powered by the ~~rechargeable~~ battery and generating negative air pressure ~~with a maximum suction of approximately 240mmHg~~;

(ii) a breast shield made up of a breast flange and a nipple tunnel; ~~and~~

(iii) a milk container that is configured to be attached to and removed from the housing; and

(iv) a diaphragm configured to be seated against a diaphragm holder that forms a recess or cavity at least in part with an external surface of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel.

2. (Currently Amended) The breast pump device of Claim 1, in which the pump comprises a piezo air pump system.

3. (Currently Amended) The breast pump device of Claim 1, in which the pump is positioned at or close to [[the]]a base of the housing.

4. (Currently Amended) The breast pump device of Claim 1, in which the pump delivers in excess of 400 mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow and is a lightweight air pump that enables [[the]]a total mass of the breast pump device ~~system~~, unfilled with milk, to be less than 250 gm.

5. (Currently Amended) The breast pump device of Claim 1, in which the breast pump device makes less than 30 dB noise at maximum power and less than 25 dB at normal power, against a 20 dB ambient noise.

6. (Original) The breast pump device of Claim 1, in which the breast shield is substantially rigid.

7. (Currently Amended) The breast pump device of Claim 1, in which the breast shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto [[the]]a breast.

8. (Currently Amended) The breast pump device of Claim 1, in which the breast shield is a one piece item that, in use, presents a single continuous surface to [[the]]a nipple and a breast.

9. (Original) The breast pump device of Claim 1, in which the breast shield integrates the breast flange and nipple tunnel as a one-piece item.

10. (Original) The breast pump device of Claim 1, in which the breast flange and the nipple tunnel are a single, integral item with no joining stubs.

11. (Currently Amended) The breast pump device of Claim 1, in which the breast shield is generally symmetrical about a centre-line running from [[the]]a top to [[the]]a bottom of the breast shield when positioned upright for normal use.

12. (Canceled)

13. (Original) The breast pump device of Claim 1, in which the housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.

14. (Currently Amended) The breast pump device of Claim 1, in which the breast pump device includes only the breast shield and the milk container ~~two parts~~ that are directly

removable from the housing in normal use or normal dis-assembly~~; the breast shield and the milk container~~.

15. (Currently Amended) The breast pump device of Claim 1, in which ~~the device includes a diaphragm that prevents milk from reaching the pump, and~~ the diaphragm is a flexible membrane.

16. (Original) The breast pump device of Claim 1, in which the diaphragm is substantially circular and is configured to self-seal under the negative air pressure to a substantially circular diaphragm holder that is part of the housing.

17. (Currently Amended) A breast pump device that is configured as a self-contained, in-bra wearable device, the breast pump device comprising: ~~The breast pump device of claim 1, in which~~

(i) a housing that includes (a) a rechargeable battery; (b) a power charging circuit for controlling the charging of the rechargeable battery; (c) control electronics powered by the rechargeable battery; and (d) a pump powered by the rechargeable battery and generating negative air pressure;

(ii) a breast shield made up of a breast flange and a nipple tunnel;

(iii) a milk container that is configured to be attached to and removed from the housing; and

[[the]]a diaphragm that is a membrane that is seated against a diaphragm holder that is formed as the recess in [[the]]a rear surface of the housing, the diaphragm deforming in response to changes in air pressure caused by the [[air]] pump to create negative air pressure in the nipple tunnel.

18. (Currently Amended) The breast pump device of Claim 1, in which the diaphragm is removable from a diaphragm holder that sits above the breast flange and the nipple tunnel. ~~portion~~

19. (Original) The breast pump device of Claim 1, in which the milk container is substantially rigid.

20. (Currently Amended) The breast pump device of Claim 1, in which the milk container is configured to attach to a lower part of the housing and to form a flat bottomed base for the breast pump device.

21. (Currently Amended) The breast pump device of Claim 1, in which the milk container has a surface shaped to continue a curved shape of the housing, so that the breast pump ~~entire~~ device can be held comfortably inside the bra.

22. (Original) The breast pump device of Claim 1, in which the milk container includes a flexible valve that self-seals under negative air pressure against a milk opening in the nipple tunnel and that permits milk to flow into the milk container.

23. (Currently Amended) The breast pump device of Claim 1, in which the milk container is attachable to the housing with a mechanical or magnetic mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.

24. (Original) The breast pump device of Claim 1, in which the milk container includes a cap that is removable from the milk container and a removable valve that enables milk to pass into the milk container in one direction.

25. (Currently Amended) The breast pump device of Claim 1, in which [[the]]a top of the milk container includes an optically clear region that is aligned below one or more light emitters positioned in [[the]]a base of the housing.

26. (Currently Amended) The breast pump device of Claim 1, in which the milk container ~~is shaped or configured to also serve as a drinking bottle that is readily held by a baby because it~~ is wider than [[it]]the milk container is tall.

27. (Currently Amended) The breast pump device of Claim 1, in which the housing includes a wireless data communications system powered by the ~~rechargeable~~ battery.

28. (Original) The breast pump device of Claim 1, in which the housing has a front surface that is configured to fit inside a bra and to contact an inner surface of the bra, and a rear surface that is shaped to contact, at least in part, the breast shield.

29. (Currently Amended) The breast pump device of Claim 1, in which the housing includes <u>at least one of</u> a visual <u>or</u> ~~and/ or~~ haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

30. (Currently Amended) The breast pump device of Claim 1, in which the housing includes <u>at least one of</u> a visual <u>or</u> ~~and/ or~~ haptic indicator that indicates if the pump is operating correctly to pump milk, based on whether [[the]]<u>a</u> quantity <u>or a</u> ~~and/ or the~~ height of ~~the~~ liquid in the milk container above [[its]]<u>a</u> base <u>of the milk container</u> is increasing above a threshold rate of increase.

31. (New) A breast pump device that is configured as a self-contained, in-bra wearable device, the breast pump device comprising:

(i) a housing that includes (a) a battery, and (b) a pump powered by the battery and generating negative air pressure;

(ii) a breast shield made up of a breast flange and a nipple tunnel;

(iii) a milk container that is configured to be attached to and removed from the housing; and

(iv) a diaphragm configured to be sealed with respect to an external portion of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel.

REMARKS

Upon entry to these amendments, claims 1-11 and 13-31 are pending in the present application. In this response, claims 1-5, 7, 8, 11, 14, 15, 17, 18, 20, 21, 23, 25-27, 29, and 30 have been amended, and claim 12 has been cancelled, without prejudice or disclaimer. New claim 31 has been added. Support for the claim amendments can be found throughout the application as originally filed. No new matter is added. Based on the above Amendments and the following Remarks, Applicant respectfully requests that the Examiner reconsider and withdraw all outstanding rejections.

Interview Summary

The undersigned would like to thank Examiner Courtney Fredrickson for her time and attention extended during the telephone interview conducted on September 23, 2021. During the interview, proposed amendments to the claims were discussed as reflected herein. The Examiner indicated that the proposed amendments should overcome the current rejections, but that further consideration and searching would be required.

Allowable Subject Matter

Applicant appreciates the Examiner's indication that previously presented claims 12 and 17 contain allowable subject matter if rewritten to overcome the rejections under 35 U.S.C. § 112(b). Applicant has amended claim 17 to be an independent claim, including the subject matter of original claim 1 and the allowable subject matter previously recited in claim 17, and addressing the rejections under 35 U.S.C § 112(b). Accordingly, Applicant respectfully submits that independent claim 17 is allowable.

Claim Objection

Claims 8, 7, and 18 were objected to due to certain informalities. In response, Applicant has amended claims 8, 7, and 18 accordingly. At least in view of the amendments, Applicant respectfully requests that the objections of these claims be withdrawn.

Claim Interpretation – 35 USC § 112(f)

The Office Action states that the previous wording of claim 22 invoked 35 U.S.C. 112(f).[1] While Applicant disagrees, Applicant has amended claim 22 to recite "a mechanical or magnetic mechanism" and respectfully submits that the amended claim does not invoke 35 U.S.C. 112(f).

Claim Rejections – 35 USC § 112(b)

Claims 3, 7, 8, 11, 12, 16-18, 25 and 30 stand rejected under 35 U.S.C. 112(b), as being indefinite. In response, Applicant has amended the claims to address the concerns raised in the Office Action.

For at least the foregoing reasons, Applicant submits that the claims are not indefinite and respectfully requests withdrawal of the rejections under 35 U.S.C. 112(b).

Claim Rejections – 35 USC § 103

Claims 1, 3, 8-11, 15, 16, 18, 21-24, and 26-28 stand rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil (US 20130023821) in view of Makower I (US 20170072118) in further view of Yodfat (US 20110009824) and in further view of Myers (US 20080275386). Claim 2 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Tanaka (US 20170035951). Claim 4 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, in further view of Chen (US 20140031744) and in further view of Mendoza (US 6227936). Claim 5 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, in further view of Baker (US 20090281485). Claim 6 stands rejected under 35 U.S.C. 103 as allegedly

[1] While the Office Action identifies claim 19 as including the language "mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action," this language is recited in claim 22 and therefore Applicant presumes that the Office Action intended to refer to claim 22 as invoking 35 U.S.C. 112(f).

being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Vogelin (US 20070179439). Claim 7 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Rigert (US 20180028733). Claim 13 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Guthrie I (US 20160220745). Claim 14 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Miller (US 20160325031). Claim 19 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Phillips (US 20160296682). Claim 20 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Thompson (US 7662018). Claim 25 stands rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Guthrie II (US 20160220743). Claims 29 and 30 stand rejected under 35 U.S.C. 103 as allegedly being unpatentable over Khalil in view of Makower I in further view of Yodfat and in further view of Myers, as applied to claim 1 above, and further in view of Makower II (US 20160206794).

Without acquiescing to the rejection of claim 1, Applicant has amended claim 1. Specifically, Applicant has amended independent claim 1 to recite, in part: "A breast pump device that is configured as a self-contained, in-bra wearable device, the breast pump device comprising: … a diaphragm configured to be seated against a diaphragm holder that forms a recess or cavity at least in part with an external surface of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel." As discussed with the Examiner during the interview, Khalil in view of Makower I, Yodfat, and Myers does not disclose or suggest at least these recitations of amended independent claim 1. For at least these reasons, Applicant respectfully requests that the

obviousness rejections of independent claim 1 and its dependent claims 2-11, 13-16, and 18-30 be withdrawn.

Double Patenting

Claims 1-11 and 13-30 stand rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-35 of U.S. Patent No. 10,926,011. Claims 1-11 and 13-30 stand rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-28 of U.S. Patent No. 10,881,766.

Claims 1-11, 13-16 and 18-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/181,057. Claims 1-11, 13-16 and 18-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,079. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,109. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,150. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,179. Claims 1-11, 13-16 and 18-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1and 6 of copending Application No. 17/203,216. Claims 1-11, 13-16 and 18-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,259. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,292. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-29 of copending Application No. 17/203,313. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-30 of copending Application No. 17/203,327. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-31 of copending Application No. 17/203,355. Claims 1-11, 13-16 and 18-30 stand provisionally rejected on the the

ground of nonstatutory double patenting as allegedly being unpatentable over claims 1and 9 of copending Application No. 17/203,384. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-31 of copending Application No. 17/203,397. Claims 1-30 stand provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1-31 of copending Application No. 17/203,418.

Applicant will address the nonstatutory double patenting rejections and will consider filing a terminal disclaimer once all the claims are indicated to be allowable.

New Claim 31

New independent claim 31 has been added. While the Examiner has yet to have the opportunity to examine this claim, Applicant respectfully submits that this independent claim is patentable, at least in view of its recitations.

CONCLUSION

In view of the foregoing, Applicant respectfully submits that no further impediments exist to the allowance of this application and, therefore, requests an indication of allowability. However, the Examiner is requested to call the undersigned if any questions or comments arise.

The Director is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-1283 referencing Docket No. ELVI-002/07US**.**

Dated: September 24, 2021

Respectfully submitted,
COOLEY LLP

By: /Kassity L. Mai/
Kassity L. Mai
Reg. No. 68,774
C. Scott Talbot
Reg. No. 34,262

USPTO CUSTOMER NO. 58249

COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue NW, Suite 700
Washington, DC 20004

Tel: (202) 842-7853
Fax: (202) 842-7899

Electronic Acknowledgement Receipt

EFS ID:	43864554
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	58249
Filer:	Kassity L. Mai/Donna Doyle
Filer Authorized By:	Kassity L. Mai
Attorney Docket Number:	ELVI-002/07US
Receipt Date:	24-SEP-2021
Filing Date:	16-MAR-2021
Time Stamp:	18:07:40
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		ELVI-002_07US-Response.pdf	181697 85d6cf33c0af5703366d58439bbe070a78cef9ac	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	12
Warnings:			
Information:			
	Total Files Size (in bytes):	181697	

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US	9649

58249 7590 09/28/2021
COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue, NW
Suite 700
Washington, DC 20004

EXAMINER	
FREDRICKSON, COURTNEY B	

ART UNIT	PAPER NUMBER
3783	

NOTIFICATION DATE	DELIVERY MODE
09/28/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

zIPPatentDocketingMailboxUS@cooley.com

Applicant-Initiated Interview Summary	Application No. 17/203,050	Applicant(s) O'TOOLE et al.		
	Examiner COURTNEY FREDRICKSON	Art Unit 3783	AIA (First Inventor to File) Status Yes	Page 1 of 2

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
COURTNEY FREDRICKSON	Examiner	Telephonic
Kassity Mai	Attorney	
Scott Talbot	Attorney	

Date of Interview: 23 September 2021

Issues Discussed:

Other

Applicant discussed the claims indicated as allowable. With respect to claim 12, Applicant discussed incorporating the subject matter regarding the breast shield sliding in/out of the housing on guide members in the breast shield into the independent claim and further defining the guide members to distinguish the claims over the prior art. The examiner indicated the allowability of the claim hinges on the breast shield sliding in/out of the housing together with the diaphragm and could not indicate if further defining the guide members would be sufficient to place the application in condition for allowance since a lot of breast pump have different mechanisms of attaching the breast shield. It was further discussed removing some components of the pump housing in claim 1 and amending the preamble to just be directed to a breast pump. The examiner indicated that removing some components would likely not impact the claim but amending the preamble would greatly change the scope of the claim with respect to the prior art.

☑ Attachment

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783	/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general

Applicant-Initiated Interview Summary	**Application No.** 17/203,050	**Applicant(s)** O'TOOLE et al.		
	Examiner COURTNEY FREDRICKSON	**Art Unit** 3783	**AIA (First Inventor to File) Status** Yes	**Page** **2 of 2**

indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Agenda for Telephone Interview
September 23, 2021; 10:00 AM ET
By e-mail – courtney.fredrickson@uspto.gov

I. PTO Representative – Examiner Courtney Fredrickson

II. Applicants' Representatives: Kassity Mai (Reg. No. 68,774), Scott Talbot (Reg. No. 34,262)

III. Discussion of following patent applications:

a. U.S. Patent Application No. 17/203,050 (Attorney Docket No. ELVI-002/07US)

b. U.S. Patent Application No. 17/203,327 (Attorney Docket No. ELVI-002/16US)

c. U.S. Patent Application No. 17,203/109 (Attorney Docket No. ELVI-002/09US)

d. U.S. Patent Application No. 17/203,292 (Attorney Docket No. ELVI-002/14US)

e. U.S. Patent Application No. 17/203,313 (Attorney Docket No. ELVI-002/15US)

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	1	of	3

Complete if Known	
Application Number	17/203,050
Filing Date	March 16, 2016
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	ELVI-002/07US

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-7666162	02-23-2010	RENZ; Charles J. et al.	
	002	US-8608685	12-17-2013	TASHIRO; Mitsuo et al.	
	003	US-10881766	01-05-2021	O'TOOLE; Jonathan et al.	
	004	US-10926011	02-23-2021	O'TOOLE; Jonathan et al.	
	005	US-20040087898	05-06-2004	WENIGER; Gotthilf	
	006	US-20090281482	11-12-2009	BAKER; Peter Christensen et al.	
	007	US-20100292636	11-18-2010	RENZ; Charles J. et al.	
	008	US-20120165729	06-28-2012	CUDWORTH; Nicholas	
	009	US-20140263611	09-18-2014	BAUER; Ryan	
	010	US-20160228625	08-11-2016	HOLTZ; Raymond et al.	
	011	US-20180110900	04-26-2018	KORENFELD; Michael S.	
	012	US-20210170080	06-10-2021	O'TOOLE; Jonathan et al.	
	013	US-20210196874	07-01-2021	O'TOOLE; Jonathan et al.	
	014	US-20210196875	07-01-2021	O'TOOLE; Jonathan et al.	
	015	US-20210196876	07-01-2021	O'TOOLE; Jonathan et al.	
	016	US-20210205511	07-08-2021	O'TOOLE; Jonathan et al.	
	017	US-20210205512	07-08-2021	O'TOOLE; Jonathan et al.	
	018	US-20210205513	07-08-2021	O'TOOLE; Jonathan et al.	
	019	US-20210205514	07-08-2021	O'TOOLE; Jonathan et al.	
	020	US-20210205515	07-08-2021	O'TOOLE; Jonathan et al.	
	021	US-20210205516	07-08-2021	O'TOOLE; Jonathan et al.	
	022	US-20210205517	07-08-2021	O'TOOLE; Jonathan et al.	
	023	US-20210205518	07-08-2021	O'TOOLE; Jonathan et al.	
	024	US-20210228789	07-29-2021	O'TOOLE; Jonathan et al.	
	025	US-20210268158	09-02-2021	O'TOOLE; Jonathan et al.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	2	of	3

Complete if Known	
Application Number	17/203,050
Filing Date	March 16, 2016
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	ELVI-002/07US

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	026	CN-101549180-A	10-07-2009	PIGEON CORP [JP]	Corresponds to US8608685	☒
	027	EP-0503280-A2	09-16-1992	PIERBURG GMBH [DE]		☒
	028	GB-2435617-B	03-05-2008	PLAYTEX PRODUCTS INC [US]		☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	3	of	3

Complete if Known	
Application Number	17/203,050
Filing Date	March 16, 2016
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	ELVI-002/07US

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	029	GB Search Report, dated 15 November 2017, issued in priority GB Application No. GB1709561.3.	☐
	030	GB Search Report, dated 28 November 2017, issued in priority GB Application No. GB1709566.2.	☐
	031	GB Search Report, dated 29 November 2017, issued in priority GB Application No. GB1709564.7.	☐
	032	International Search Report issued in PCT/GB2018/051659 dated December 4, 2018, 9 pages.	☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Bibliographic data

Title: Breast pump

Pub/Pat no: CN101549180A

Pub/Issue Date: 2009-10-07

Inventor(s): MITSUO TASHIRO[JP]| SHINICHI KATAOKA[JP]|TASHIRO MITSUO |KATAOKA SHINICHI

Applicant(s): PIGEON CORP[JP]

Classification: A61M1/06AI

Application number: CN200910134014 2009-04-03

Priority number: JP20080098492 2008-04-04;

Abstract of CN101549180A

A breast pump can be configured to be capable of easily attaching/detaching a primary side serving as a sealed space which is in communication with a milking space and allows the passage of breast milk, with a secondary side in which a case is connected with a pressure changing apparatus 51. The breast pump can include a breast pump main body 21 connected to the pressure changing apparatus by a conduit, wherein a milking part is disposed so as to liquid-tightly separate a sealed space (or a space that is in fluid communication with the sealed space), and the pressure changing apparatus from each other. A pressure transmission part 30 for transmitting pressure changed by the pressure changing apparatus can be provided. The pressure transmission part can include a deformable part 32 where a volume in the sealed space can be deformed by a pressure fluctuation generated by the pressure changing apparatus. A case 31 can accommodate the deformable part and be connected with the pressure changing apparatus at one end, and the other end of the case can include attachment structure 33 for communicably attaching/detaching the case with the portion of the milking part that forms the sealed space.

[19] 中华人民共和国国家知识产权局

[51] Int. Cl.
A61M 1/06 (2006.01)

[12] 发明专利申请公布说明书

[21] 申请号 200910134014.1

[43] 公开日 2009 年 10 月 7 日

[11] 公开号 CN 101549180A

[22] 申请日 2009.4.3
[21] 申请号 200910134014.1
[30] 优先权
[32] 2008. 4. 4 [33] JP [31] 2008－098492

[71] 申请人 贝亲株式会社
地址 日本东京都
[72] 发明人 田代光雄 片冈信一

[74] 专利代理机构 北京市金杜律师事务所
代理人 陈 伟

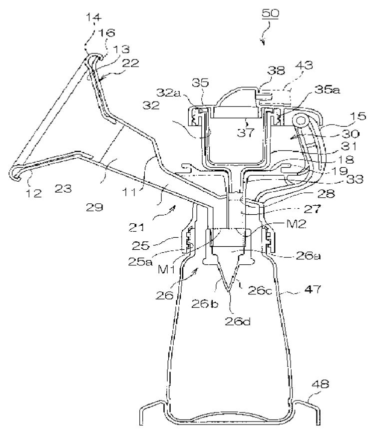
权利要求书 2 页 说明书 16 页 附图 9 页

[54] 发明名称

吸奶器

[57] 摘要

本发明提供一种吸奶器，能够容易地对与吸奶空间连通的母乳所通过的密闭空间即一次侧和与压力改变机构连接的壳体所存在的一侧即二次侧进行装拆。吸奶器具有吸奶器主体(21)和压力改变机构(51)，吸奶部具有用于传递通过所述压力改变机构被改变的压力的压力传递部(30)，该压力传递部将密闭空间或与其连通的空间和所述压力改变机构液密地分离。所述压力传递部具有：变形部(32)，该变形部使所述密闭空间或与该密闭空间连通的空间内所占的体积或容积因所述压力改变机构所产生的压力变化而变形；壳体(31)，用于收容该变形部，并且一端与所述压力改变机构侧连接，在该壳体的另一端，具有用于以能够连通的方式对该壳体内和所述密闭空间进行装拆的装拆机构(33)。



1. 一种吸奶器，具有：与使用者的乳房抵接的大致圆锥状的吸奶部；包含所述吸奶部、以连通的方式与瓶进行装拆的吸奶器主体；与所述吸奶部连接，交替地产生负压状态以及比该负压状态压力高的至少大气压状态的压力改变机构，其特征在于，

具有用于传递通过所述压力改变机构被改变的压力的压力传递部，该压力传递部被配置成，当所述吸奶部进行吸奶时，将因抵接使用者的乳房而形成的密闭空间或与该密闭空间连通的空间和所述压力改变机构液密地分离，

所述压力传递部具有：变形部，该变形部使所述密闭空间或与该密闭空间连通的空间内所占的体积或容积因所述压力改变机构所产生的压力变化而变形；壳体，用于收容该变形部，并且一端与所述压力改变机构侧连接，

在该壳体的另一端，具有用于以能够连通的方式对该壳体内和所述密闭空间进行装拆的装拆机构。

2. 如权利要求1所述的吸奶器，其特征在于，所述壳体是在内部收容了所述变形部的筒状体，在该筒状体上具有作为所述装拆机构的、从与所述另一端对应的端部突出的管状突出部，而在所述密闭空间中，具有在该空间内延伸的筒状连接部，使所述筒状连接部的内径比所述壳体侧的所述管状突出部的外径稍大，由此，将所述管状突出部插入所述筒状连接部，成为所述壳体和所述密闭空间被气密接合的结构。

3. 如权利要求2所述的吸奶器，其特征在于，所述壳体的所述管状突出部的周边为平坦的底部，在所述吸奶器主体的所述筒状连接部的开口周边形成有平坦的接触面部，将所述管状突出部插入所述筒状连接部，将所述壳体的所述平坦的底部推入至与所述平坦的接触面部抵接的位置，由此，成为所述壳体和所述密闭空间气密接合的结构。

4. 如权利要求3所述的吸奶器，其特征在于，所述筒状连接部以在将所述吸奶器主体载置在所述瓶上的状态下、向瓶下方大致垂直延伸的方式形成，并且，所述管状突出部向前端逐渐变细。

5. 如权利要求1～4的任一项所述的吸奶器，其特征在于，具有盖部件，该盖部件将收纳所述变形部的所述壳体的一端侧覆盖，并且，与作为所述压力改变机构的负压形成机构连接的管相对于该盖部件装拆，所述盖部件具有卡定机构，在所述壳体和所述密闭空间被接合的状态下，所述卡定机构用于在将所述盖部件安装在所述壳体的一端侧的位置上，将该盖部件相对于所述吸奶器主体的所述密闭空间侧进行卡定。

6. 如权利要求5所述的吸奶器，其特征在于，所述卡定机构设置在所述盖部件的周缘部，该卡定机构相对于从所述吸奶器主体侧向上方突出的支承机构被卡定。

7. 如权利要求5所述的吸奶器，其特征在于，使从所述盖部件的周缘部延伸的卡定机构相对于在所述吸奶器主体的所述筒状连接部的开口周边所设置的接触面部的周缘部进行卡定。

吸奶器

技术领域

本发明涉及用于吸取母乳的吸奶器的改进。

背景技术

供母亲等吸取母乳使用的吸奶器，例如具有用于与乳房抵接的喇叭部、和用于在因乳房抵接该喇叭部而形成的空间中产生负压的泵等的负压形成机构。被吸引到负压空间的母乳流入瓶等中而被贮存，负压形成空间和所述泵通过连接机构连接（参照专利文献 1）。

在这样的吸奶器中，被收容在设置于所述连接机构的外壳中的阀体根据母乳液面的上升而可动，从而阻塞向负压形成机构即所述泵侧的开口。由此，能够防止母乳回流到负压形成机构即泵侧，并能够防止机械结构生锈及被污染。另外，即使在负压形成机构不是由泵等的机械构造构成、而是由杆等的手动机构构成的情况下，也能够避免因母乳回流到该杆等而沾污使用者的手等不良情况。

但是，在这样的吸奶器中，设置在所述连接机构上的、将所述负压空间和所述泵侧连通的开口，是会因阀体的动作而被阻塞的构造。

因此，负压空间和泵侧无法成为始终完全地液密分离的构造，即使阀体将所述开口阻塞，也存在着母乳本身以及随负压成为雾状的母乳等从微小的间隙回流到泵侧的危险。

因此，可能会造成泵的机械部分污损、杂菌繁殖，在手动的负压形成机构中也同样存在着污损和不卫生的问题。

因此，本申请中提出了专利文献 2 所示的吸奶器。

该吸奶器中具有压力传递部，该压力传递部被配置成，当吸奶部进行吸奶时，能够将因与使用者的乳房抵接而形成的密闭空间、

或与该密闭空间连通的空间和所述压力改变机构液密地分离，该压力传递部用于传递被所述压力改变机构改变了的压力，所述压力传递部具有变形部，该变形部在所述密闭空间或与该密闭空间连通的空间内所占的体积或容积因所述压力改变机构的动作而变化。

因此，由于压力传递部将形成于所述吸奶部的所述密闭空间和泵等的压力改变机构完全液密分离，因而能够有效地防止吸取出的母乳从所述密闭空间侧回流到所述压力改变机构。其结果是，能够有效地防止压力改变机构侧接触母乳而产生腐蚀和破损，或是被污染成为不卫生的状态。

专利文献 1：日本特开平 11-226117

专利文献 2：日本特开 2006-102220

但是，在专利文献 2 的吸奶器中，虽然能够实现将与吸奶空间连通的母乳所通过的密闭空间即一次侧和与压力改变机构连接的壳体所存在的一侧即二次侧液密分离的结构，但它们在构造上是相互结合的构造。

因此，在搬运时、收纳时等，一次侧的构造和二次侧的构造是结合的，因而产生了操作、清洁时等不方便的另外的问题。

发明内容

因此，本发明的目的在于提供一种吸奶器，能够容易地对与吸奶空间连通的母乳所通过的密闭空间即一次侧和与压力改变机构连接的壳体所存在的一侧即二次侧进行装拆，并能够使清洁等的操作变得极其容易。

上述目的在第一发明中是通过如下所述的吸奶器实现的，吸奶器具有：与使用者的乳房抵接的大致圆锥状的吸奶部；包含所述吸奶部、以连通的方式与瓶进行装拆的吸奶器主体；与所述吸奶部连接，交替地产生负压状态以及比该负压状态压力高的至少大气压状态的压力改变机构，其中，具有用于传递通过所述压力改变机构被改变的压力的压力传递部，该压力传递部被配置成，当所述吸奶部

进行吸奶时，将因抵接使用者的乳房而形成的密闭空间或与该密闭空间连通的空间和所述压力改变机构液密地分离，所述压力传递部具有：变形部，该变形部使所述密闭空间或与该密闭空间连通的空间内所占的体积或容积因所述压力改变机构所产生的压力变化而变形；壳体，用于收容该变形部，并且一端与所述压力改变机构侧连接，在该壳体的另一端，具有用于以能够连通的方式对该壳体内和所述密闭空间进行装拆的装拆机构。

根据第一发明的结构，所述压力传递机构通过壳体内收容的所述变形部的体积变化使所述密闭空间的内压变化，由此，改变对抵接于所述吸奶部的乳房的吸引压。

而且，因此，由于所述压力传递部将形成于所述吸奶部的所述密闭空间和泵等的压力改变机构完全地分离，因而能够有效地防止吸取出的母乳从所述密闭空间侧回流到所述压力改变机构。因此，能够有效地防止压力改变机构侧与母乳接触发生腐蚀、破损而被污染成为不卫生的状态。

而且，所述压力传递部具有一端与所述压力改变机构侧连接的壳体，在该壳体的另一端具有用于将该壳体内和所述密闭空间以能够连通的方式进行装拆的装拆机构。因此，例如，能够容易地将收容有变形部的壳体装拆，与密闭空间侧分离，不仅便于携带、移动，尤其在清洗时等，能够容易地仅对需要频繁清洗的一次侧即密闭空间侧进行分离、清洗。

第二发明在第一发明的结构的基础上，所述壳体是在内部收容了所述变形部的筒状体，在该筒状体上具有作为所述装拆机构的、从与所述另一端对应的端部突出的管状突出部，而在所述密闭空间中，具有在该空间内延伸的筒状连接部，使所述筒状连接部的内径比所述壳体侧的所述管状突出部的外径稍大，由此，将所述管状突出部插入所述筒状连接部，成为所述壳体和所述密闭空间被气密接合的结构。

根据第二发明的结构，在所述密闭空间中设置有筒状连接部，

由于该筒状连接部具有比壳体侧的管状突出部的外径稍大的内径，所以通过仅将该管状突出部插入筒状连接部这一简单的操作，就能够将压力改变机构侧和密闭空间侧连接。

第三发明在第二发明的结构的基础上，所述壳体的所述管状突出部的周边为平坦的底部，在所述吸奶器主体的所述筒状连接部的开口周边形成有平坦的接触面部，将所述管状突出部插入所述筒状连接部，将所述壳体的所述平坦的底部推入至与所述平坦的接触面部抵接的位置，由此，成为所述壳体和所述密闭空间气密接合的结构。

根据第三发明的结构，所述壳体的所述管状突出部的周边为平坦的底部，在所述吸奶器主体的所述筒状连接部的开口周边形成有平坦的接触面部，只要将所述管状突出部插入所述筒状连接部、将所述壳体的所述平坦的底部压入到与所述平坦的接触面部抵接的位置，便能够极其容易地将所述壳体和所述密闭空间接合。

第四发明在第三发明的结构的基础上，所述筒状连接部以在将所述吸奶器主体载置在所述瓶上的状态下、向瓶下方大致垂直延伸的方式形成，并且，所述管状突出部向前端逐渐变细。

根据第四发明的结构，只要将管状突出部向下插入筒状连接部，由于前端细而插入容易，并且当插入得较深时，随着该管状突出部的外径扩大，该管状突出部能够与筒状连接部的内表面紧密地接触、实现嵌合，能够极其容易地接合。

第五发明在第一～第四任意一个发明的结构的基础上，具有盖部件，该盖部件将收纳所述变形部的所述壳体的一端侧覆盖，并且，与作为所述压力改变机构的负压形成机构连接的管相对于该盖部件装拆，所述盖部件具有卡定机构，在所述壳体和所述密闭空间被接合的状态下，所述卡定机构用于在将所述盖部件安装在所述壳体的一端侧的位置上，将该盖部件相对于所述吸奶器主体的所述密闭空间侧进行卡定。

根据第五发明的结构，所述盖部件具有所述卡定机构，由此，

能够使壳体相对于密闭空间侧的接合状态不会轻易脱落。

第六发明在第五发明的结构的基础上，所述卡定机构设置在所述盖部件的周缘部，该卡定机构相对于从所述吸奶器主体侧向上方突出的支承机构被卡定。

根据第六发明的结构，卡定机构设置在所述盖部件的周缘部，由于该卡定机构是相对于从所述吸奶器主体侧向上方突出的支承机构被卡定的结构，因此，在与所述管状突出部和筒状连接部的接合位置不同的位置进行所述卡定机构的卡定，能够更稳定地维持接合状态。

第七发明在第五发明的结构的基础上，使从所述盖部件的周缘部延伸的卡定机构相对于在所述吸奶器主体的所述筒状连接部的开口周边所设置的接触面部的周缘部进行卡定。

根据第七发明的结构，由于能够利用在吸奶器主体的所述筒状连接部的开口周边所设置的接触面部来卡定盖部件，因而不需要在吸奶器主体侧形成用于卡定的特别的机构，另外，还能够相应地谋求小型化。

（发明的效果）

如上所述，根据本发明，能够提供一种吸奶器，能够容易地对与吸奶空间连通的母乳所通过的密闭空间即一次侧和与压力改变机构连接的壳体所存在的一侧即二次侧进行装拆，并能够使清洁等的操作变得极其容易。

附图说明

图 1 是本发明的第一实施方式的吸奶器的概略立体图。

图 2 是图 1 的吸奶器的吸奶单元的概略剖视图。

图 3 是图 1 的吸奶器的盖部件的概略立体图。

图 4 是图 1 的吸奶器的电机部的分解立体图。

图 5 是图 1 的吸奶器的活塞部的分解立体图。

图 6 是图 1 的吸奶器的压力调整部的分解立体图。

图 7 是图 1 的吸奶器的变形例一的说明图。

图 8 是图 1 的吸奶器的变形例二的说明图。

图 9 是本发明的第二实施方式的吸奶器的主要部位的图。

（附图标记的说明）

15…支承机构，20…吸奶器，21…（吸奶器）主体，22…吸奶部，23…通气路，28…筒状连接部，29…密闭空间，30…压力传递部，31…壳体，32…变形部（件），33…（装拆机构）管状突出部，35…盖部件，50…吸奶单元，51…泵单元

具体实施方式

以下，参照附图详细说明本发明的优选实施方式。

另外，由于以下所述的实施方式是本发明的优选具体例，因而在技术方面附加了优选的各种限定，但只要在以下的说明中没有特别限定本发明的主旨的记载，本发明的范围就不限于这些实施方式。

图 1 是表示本发明的实施方式的吸奶器的结构的概略立体图。

图 1 表示吸奶器 20 的整体，在图中，吸奶器 20 具有吸奶单元 50 和通过管 43 与该吸奶单元 50 连接的作为压力改变机构的泵单元 51。

首先，对吸奶单元 50 进行说明。

图 2 是吸奶单元 50 的概略剖视图，在图 1 以及图 2 中，吸奶单元 50 具有吸奶器主体 21（以下称为“主体”），该吸奶器主体 21 能够相对于用于贮存吸取出的母乳的容器即瓶 47 装拆。

主体 21 例如其整体由较轻的、牢固的合成树脂材料成形，例如，由聚碳酸酯、聚环烯烃、聚醚砜、聚酰胺、聚丙烯等形成。

如图 2 所示，主体 21 具有与用于贮存吸取出的母乳的瓶 47 进行装拆的装拆部 25。装拆部 25 是例如扁平的筒状部分，在内侧具有内螺纹部 25a，该内螺纹部 25a 与形成在瓶 47 的瓶口周围的外螺纹部螺合。此外，瓶 47 可以是吸奶器 20 的专用品，也可以使用能与装拆部 25 配合的哺乳瓶等瓶体。此外，瓶 47 被载置在支承台 48 上。

在图 2 中，在主体 21 的装拆部 25 的上部，设置有以斜向倾斜的状态向外敞开的圆锥状或喇叭状的吸奶部 22。

该吸奶部 22 具有：构成通气路 23 的稍微扩开的开放通路 11；一体设置在开放通路 11 的前端侧的、大幅扩开成喇叭状的开放前端部 12。它们由与主体 21 相同的材料成形，具有较高的刚性，不易变形。

另外，在开放前端部 12 的内侧，设置有形状与开放前端部 12 大致相同的筒状的吸奶口变形部件 13。吸奶口变形部件 13 能够相对于开放前端部 12 装拆。该吸奶口变形部件 13 由硅橡胶、人造橡胶、天然橡胶等弹性体形成。

另外，在吸奶口变形部件 13 的开放前端部 12，以覆盖其全周的方式设有凸状刺激部 14。

在密闭空间的负压升高时，凸状刺激部 14 与乳房抵接、提高乳房与密闭空间的密闭性，并且，推压乳房、随着吸奶的进行给予良性刺激，发挥按摩的效果。

吸奶部 22 的通气路 23 作为通气以及吸取出的母乳的通路，是向斜上方逐渐扩大的筒状，其下端侧向下方弯折并朝向瓶 47 侧。

另外，吸奶部 22 的通气路 23 的开口 M1 位于主体 21 与瓶 47 之间的装拆部 25 的内侧，并安装有小室阀 26。与通气路 23 邻接地设置有另一个通气路 27。

通气路 27 的下端开口 M2 如图所示地在小室阀 26 中与通气路 23 连通，通气路 27 的上端向上方延伸并与压力传递部 30 的壳体 31 下端连通。

因此，由吸奶部 22 的内侧和通气路 23、通气路 27 形成在吸奶时形成吸引母乳的负压的密闭空间 29。

如图 2 所示，上述小室阀 26 是整体由硅橡胶、人造橡胶、天然橡胶等弹性体形成的帽状的形态，图 2 的两侧壁 26b、26c 是向下端幅宽逐渐相互接近地形成的弹性体的倾斜壁。在两侧壁 26b、26c 的接近的下端，设置有狭缝 26d，吸取的母乳在小室 26a 中贮存到规定

量时，伴随其重量和如下所述的负压解除时的压力的变化，两侧壁26b、26c的前端侧打开，狭缝26d开放，母乳流入瓶47内。另外，通过在倾斜壁的下端形成狭缝26d，能够发挥防止负压时瓶47内的空气进入小室26a的空气阀的功能。

主体21的通气路27的上部与后述的筒状连接部28一体形成，在其上部，沿着该筒状连接部28的开口的周边部形成有接触面部18。该接触面部18是当装拆后述的壳体31时进行抵接、配置的部分，是呈适于容纳该壳体31的底面的形态的平坦或略呈凹状的皿状的部分，在其外缘形成有凸缘部19。

而且，在与主体21的吸奶部22外伸的部位相反的一侧，形成有向上方突出的支承机构15。在本实施方式中，支承机构15是例如从上述接触面部18的侧方的位置向上方延伸的部分，是以支柱状或臂状起立的突出体。支承机构15的上端到达图2的壳体31的上端附近。相对于该支承机构15，通过如下述那样支承壳体31的盖部件35，从而经由该盖部件35稳定地支承壳体31。

图3是表示壳体31的从下方观察的概略立体图，图3（a）是将盖部件35安装在壳体31上的状态，图3（b）是分解立体图。

压力传递部30的壳体31在该情况下例如是纵向长的圆筒体，其内部空间也是纵向长的空间，并收容有变形部。变形部在本实施方式中是与壳体31分体的独立部件，作为能够相对于壳体31装拆的变形部件32而构成。

变形部件32由不透气的薄材料形成，具有柔软的性质，能够容易地变形。

尤其，在本实施方式中，如图2以及图3所示，变形部件32是以与由硬质的合成树脂的成形品等形成的圆筒壳体即壳体31的内侧空间内接的形状形成的、一端开口而另一端被封闭的有底圆筒形的变形部件，例如是由硅橡胶、人造橡胶、天然橡胶等的弹性体、以极其柔软、不会因反复伸缩的变形而产生断裂等情况的材料形成的。

如图2以及图3所示，变形部件32在其上端的开口周缘部一体

地具有凸缘部 32a，该凸缘部 32a 载置、抵接在壳体 31 的上端开口的周缘部上。

在壳体 31 的上端开口的外缘部，形成有外螺纹部等的装拆机构 34，通过螺纹旋入盖部件 35 的下侧内周 35a 等方法，盖部件 35 能够相对于壳体 31 装拆（参照图 2）。

在盖部件 35 的内侧，在其下端设置有较低地向下方突出的肋 37。

由此，在盖部件 35 通过螺纹旋入而相对于壳体 31 完成安装的图 2 的状态下，由于该变形部件 32 的凸缘部 32a 以紧密接触的方式被夹在壳体 31 的开口周缘部的上表面与盖部件 35 的下表面之间，因而变形部件 32 的内侧成为气密的状态。

而且，在盖部件 35 的上端，在本实施方式的情况下，具有向横向略微突出的安装部 38，通过将其插入图 1 所示的可挠性的管 43 的端部，能够与该管 43 实现装拆，在图 2 的状态下，管 43 经由盖部件 35 与变形部件 32 的内侧空间连通。因此，该空间经由管 43 成为与后述的压力改变机构连通的二次侧的空间。

该二次侧的空间通过变形部件 32 与一次侧的空间即密闭空间 29 液密地分离，该一次侧的空间包括经由从图 2 的吸奶部 22 的通气路 23 连续的小室 26a 而连通的通气路 27、以及经由后述的装拆机构 33 连接的壳体 31 的内部。也就是说，以气体或液体都完全不会漏出的方式气密且液密地实现密封。

而且，如图 2 以及图 3 所示，在壳体 31 的下端，平坦的底部 39 的中央部较细地向下方垂直突出，形成有内部为空洞的筒状的作为上述装拆机构的管状突出部 33。该管状突出部 33 优选随着趋向前端其外径逐渐变细。

与此相应地，在图 2 所说明的主体 21 的接触面部 18 的中心附近，形成有筒状连接部 28。如图所示，该筒状连接部 28 向瓶 47 垂直地延伸并与小室 26a 连通。而且，通过使筒状连接部 28 的内径比壳体 31 的管状突出部 33 的外径略大，当该管状突出部 33 被插入时，

筒状连接部28的内径与其以紧密接触的方式外接，在该状态下能够保持气密状态。

图2表示了如上述这样、将管状突出部33嵌入筒状连接部28中的状态，另外，在盖部件35被安装到壳体31上的状态下，盖部件35的卡定机构36卡定于支承机构15，从而稳定地维持壳体31的安装状态。

即，盖部件35的外周缘部横向延长，形成由收容支承机构15的上端的凹部等构成的卡定机构36。

由此，在通过螺纹旋入等方法将盖部件35安装在收容了变形部件32的壳体31的上端的状态下，与将该壳体31的管状突出部33嵌入筒状连接部28同时地，通过使支承机构15的前端收容到盖部件35的卡定机构36中，由此，不但能够简单地进行安装，还能够通过安装部和卡定部这两点进行支承，从而稳定地保持安装状态。

以下说明作为压力改变机构的泵单元51。

图1中表示了泵单元51的概略立体图。

如图1所说明的那样，泵单元51通过可挠性的管43与吸奶单元50连接。泵单元51作为真空泵，当后述的开关被打开时，能够将吸奶单元50的二次侧的空间即压力传递部30的壳体31内以及与其连通的空间吸成负压。在此情况下，根据后述的构造，能够以脉动状态实现负压形成。即，能够进行如下的脉动压力变动：使压力变动而连续地进行从负压状态至少到大气压状态的变动。

在图1中，在泵单元51的箱体52上露出有：将泵单元51的驱动打开、关闭的开关（按钮）54；用于调整负压形成过程中的脉动的周期的循环按钮55；用于调整负压压力的旋钮53。另外，在泵单元52上还安装有可挠性的管43。

参照图4至图6。

在泵单元51的箱体52的内侧，收容有电机部70、气缸部60、压力调整部90等。

电机部70具有电机72和该电机72的电机轴结合于其上的齿轮

单元 73。电机 72 在本实施方式中使用直流电机。

齿轮单元 73 中，延伸有使电机轴的旋转适当减速而进行传递的驱动轴 74，该驱动轴 74 与偏心凸轮 63 连接。偏心凸轮 63 的凸轮轴与气缸部 60 的活塞杆连接，驱动轴 74 的旋转运动被转换成活塞杆的往复运动。

即，气缸部 60 具有气缸 62，在该气缸 62 内，以能够进退的方式插入活塞杆 67。在活塞杆 67 的活塞头上安装有其间夹有垫片 66 的两个活塞环 64a、64b，利用固定板 65 将其用螺丝固定。

在气缸 62 内部，连通有吸引管 85、排气管 86、压力调整管 87。由此，通过活塞杆 67 进行往复运动，借助规定的阀驱动，在气缸 62 内形成负压，该负压经由吸引管 85 进行传递。

在此，通过适当地选择活塞环 64a、64b 的材质，能够降低活塞杆 67 在气缸 62 内的滑动阻力，减少电力损耗，能够谋求节能化，并能够提高密封性。

因此，这些活塞环 64a、64b 优选由特氟隆（注册商标）、尼龙、聚甲醛等耐热性较好且滑动阻力低的材料形成，具有比气缸内径稍大的外径，并形成有活塞鳍片，随着活塞杆 67 的往复运动，该活塞鳍片与气缸 62 的内壁接触的凸缘状的外缘部能够变形。

为了谋求活塞杆 67 在气缸 62 内的滑动阻力的降低、并使密封性良好，作为活塞环 64a、64b 的材质，可以选择特氟隆（注册商标）。

但是，由于特氟隆（注册商标）无法在模具内成形，因而存在着制造成本升高的缺点。

因此，在本实施方式中，以聚甲醛的成形品来形成这些活塞环 64a、64b。由此，能够降低活塞杆 67 在气缸 62 内的滑动阻力，减少电力损耗，能够谋求节能化，并且能够提高密封性，还能够实现制造成本的降低。

排气管 86 与排气阀连接。吸引管 85 经由管安装口如图 1 所示从箱体 52 露出，与可挠性的管 43 连接，从而与吸奶单元 50 的盖部件 35 连接。压力调整管 87 与压力调整部 90 连接。

在箱体 52 内收纳有控制电路基板，该控制电路基板例如被固定支承在收纳单元中，该控制电路基板控制泵单元 51 的驱动，并连接有泵单元 51 的打开关闭开关（按钮）54 和用于调整负压形成中的脉动周期的循环按钮 55 等。

压力调整部 90 与气缸部 60 的气缸 62 连通，具有零件的收纳壳体 91。在该收纳壳体 91 内具有板 92，为了调整气缸 62 内的负压，该板 92 具有直径大的负压调整用孔和直径小的负压调整用孔。通过使该板 92 旋转来进行板 92 的这些孔的切换。板 92 通过衬垫 93 和垫块 94 被固定在按钮 53 上。

本实施方式的吸奶器 20 如上所述地构成，在图 1 中，操作泵单元 51 打开关闭开关按钮 54，起动该泵单元 51 时，电机 72 旋转，驱动轴 74 经由齿轮单元 73 旋转，该旋转运动经由偏心凸轮 63 被转换成气缸 62 内的活塞杆 67 的往复运动。通过活塞杆的往复运动，气缸 62 内形成的负压脉动变化，经由吸引管 85 以及可挠性的管 43 被传递到图示的吸奶单元 50 的压力传递部 30。

由此，在图 2 中，壳体 31 内的变形部件 32 内部的气压降低。因此，在壳体 31 内，由于与变形部件 32 的外侧的空间之间的气压差，变形部件 32 的内部空间以被压溃的方式变形，其底部上升、接近盖部件 35 侧。即，由于变形部 32 在壳体 31 内大幅度地减小体积，所以与变形部件 32 的外侧的壳体 31 的空间连通的密闭空间 29 内，气压大幅度地减小。

即，由于在密闭空间 29 内负压增大，因而母乳被从乳房吸引，被吸取出的母乳通过通气路 23 内，流入小室 26a。而且，此时，伴随着压力差，吸奶口变形部件 13 的凸状刺激部 14 向乳房侧变形，推压乳房进行刺激，因而能够进一步促进母乳的分泌。

接着，当基于泵单元 51 的气缸杆 67 的往复动作，负压状态被解除时，再次如图 2 所示地，变形部件 32 以恢复其形态的方式变位。由此，在壳体 31 内，当由于变形部件 32 使体积增大而使密闭空间内的气压升高时，母乳的吸引压降低。

通过重复进行以上动作，作为压力改变机构的泵单元51的动作通过压力传递部30的变形部件32的动作被传递至密闭空间29，从而密闭空间29的负压被增减，由此，实现与婴儿的哺乳动作接近的状态，能够使吸取出的母乳贮存在瓶47中。

另外，在此，在上述动作中，当经由管43作用负压时，变形部件32以向盖部件35侧贴靠的方式收缩变形。此时，虽然收缩变形了的变形部件32欲贴靠盖部件35侧，但由于肋37的存在，能够阻止其完全地贴靠。

而且，压力传递部30具有上端经由盖部件35与泵单元51连接的壳体31，在该壳体31的下端具有装拆机构33，该装拆机构33用于将该壳体31内和密闭空间29以能够连通的方式装拆。由此，例如，能够容易地对收容有变形部件32的壳体31进行装拆，并能够使其与密闭空间29侧分离，不仅便于携带、移动，尤其在清洗时等，能够容易地仅对需要频繁清洗的一次侧即密闭空间29侧进行分离、清洗。

这样，能够容易地对与吸奶空间连通的母乳所通过的密闭空间29即一次侧和与压力改变机构即泵单元51侧连接的壳体31的侧即二次侧进行装拆，能够使清扫等的操作变得极其容易。

另外，由于压力传递部30将形成于吸奶部22的密闭空间和泵等的压力改变机构完全液密且气密地分离，所以能够有效地防止滞留在密闭空间侧即小室26a等的母乳或成为雾状的母乳回流到泵单元51。因此，能够有效地防止泵单元51等的压力改变机构侧接触到母乳而发生腐蚀、破损以及被污染成为不卫生的状态。

另外，在本实施方式中，壳体31是内部收容有变形部件32的筒状体，在该筒状体上具有作为装拆机构的管状突出部33。

而且，在密闭空间29中，具有在该密闭空间29内延伸的筒状连接部28，通过使筒状连接部28的内径比管状突出部33的外径稍大，从而成为将管状突出部33插入筒状连接部28、壳体31和密闭空间29气密地接合的结构。

由此，通过仅将管状突出部 33 插入筒状连接部 28 这一简单的操作，就能够将泵单元 51 侧和密闭空间 29 侧连接。

而且，如上所述，壳体 31 的管状突出部 33 的周边为平坦的底部，在主体 21 的筒状连接部 28 的开口周边形成有平坦的接触面部 18。因此，只要将管状突出部 33 插入筒状连接部 28、将壳体 31 的平坦的底部压入到与平坦的接触面部 18 抵接的位置，便能够极其容易地以气密状态将壳体 31 和密闭空间 29 接合。

而且，上述筒状连接部 28 是如图 2 所示、在载置瓶 47 的状态下向瓶 47 下方大致垂直延伸而形成的，管状突出部 33 以向前端逐渐变细的方式形成。

因此，只通过将管状突出部 33 向下插入筒状连接部 28，由于前端细而插入容易，并且当插入得较深时，随着该管状突出部 33 的外径扩大，该管状突出部 33 能够与筒状连接部 28 的内表面紧密地接触、实现嵌合，能够极其容易地接合。

而且，在本实施方式中，具有盖部件 35，该盖部件 35 覆盖收纳变形部 32 的壳体 31 的上端侧，并且，与作为压力改变机构的负压形成机构即管单元 51 连接的管 43 能够相对于该盖部件 35 装拆。

而且，在壳体 31 和密闭空间 29 被接合的状态下，在将盖部件 35 安装到壳体 31 的上端侧的位置上，具有用于将盖部件 35 相对于主体 21 的密闭空间 29 侧进行卡定的卡定机构 36，因此，壳体 31 的相对于密闭空间 29 侧的接合状态被稳定地支承，不会轻易脱落。

而且，在本实施方式中，图 3 的卡定机构 36 设置在盖部件 35 的周缘部上。该卡定机构 36 是如图 2 所说明的那样、相对于从主体 21 侧向上方突出的支承机构 15 被卡定的结构。

由此，在与管状突出部 33 和筒状连接部 28 的接合位置不同的位置进行该卡定，能够更稳定地维持接合状态。

图 7 及图 8 表示设置在盖部件上的卡定机构的变形例。

图 7 表示第一变形例，盖部件的结构与图 3 的情况稍有不同。

在该例中，盖部件 35-1 的外缘具有向下方延长的一对脚片 36-1、

36-1，该脚片 36-1、36-1 能够根据规定的弹性向相互接近、远离的方向变形。在各脚片 36-1、36-1 的下端附近形成有钩状的卡定部 45、45。

因此，如图 7 的下部所示，当使盖部件 35-1 相对于壳体 31 从上方下降进行覆盖时，各脚片 36-1、36-1 与接触面部 18 的凸缘部 19 接触，通过略微打开各脚片 36-1、36-1 便能够越过凸缘部 19 的外缘，该凸缘部 19 进入各脚片 36-1、36-1 的卡定部 45、45 而被卡定。

图 8 表示第二变形例，盖部件的结构与图 3 的情况稍有不同。

在该例中，在盖部件 35-2 上不仅形成有与图 3 的盖部件 35 相同的卡定机构 36，而且其相反侧的端部外缘向下方延长，形成有脚片 36-2。在该脚片 36-2 的下端部形成有钩状的卡定部 46。

由此，盖部件 35-2 通过卡定部 46 在卡定在凸缘部 19 上的同时，相对于支承机构 15 也被卡定。

这样，根据各变形例，在与管状突出部和筒状连接部的接合位置不同的位置，通过卡定机构实现卡定，能够更稳定地维持接合状态。不仅如此，由于能够利用主体 21 的筒状连接部的开口周边所设置的接触面部 18 卡定盖部件，因而不需要在主体 21 侧形成用于卡定的特别的机构，另外，还能够相应地谋求小型化。

图 9 表示第二实施方式的主要部位，图示的结构以外的结构与第一实施方式相同，因此以下以不同点为中心进行说明。

在图 9（a）中，壳体 31 能够相对于吸奶单元 50-1 的主体 21 装拆。该壳体 31 的下端部如图 9（b）所示，成为在径向上鼓出的凸缘状的卡定机构 41。

即，该卡定机构 41 具有鼓出成凸缘状的周缘向下方弯折且其前端趋向内侧的阶梯部 41b，接触面部 18 的凸缘部 19 的前端能够卡定在该阶梯部上。

如图 9（a）所示，在卡定机构 41 上，沿其圆周方向形成有多个狭缝 41a，由此，该卡定机构 41 能够弹性变形，通过如图 9（b）所示那样嵌入接触面部 18 的凸缘部 19，能够容易地变形、装拆。

本实施方式如上所述地构成，不仅能够发挥与第一实施方式相同的作用效果，即使不使用图 2 那样的支承机构 15，也能够形成用于维持壳体 31 的接合状态的卡定机构。

因此，即使省略图 2 那样的支承机构 15，也能够得到与第一实施方式同等的接合稳定性。

此外，本发明不限于上述实施方式。

例如，壳体 31 中收容的变形部件可以与壳体一体地构成，成为作为其一部分的“变形部”。

变形部不仅可以是有底圆筒体，也可以使用折皱构造等各种形态。

装折机构即管状突出部 33 可以适当地改变成与实施方式不同的形状、构造。

此外，上述各实施方式、变形例的个别结构可以根据需要省略，或与未说明的其他结构进行组合。

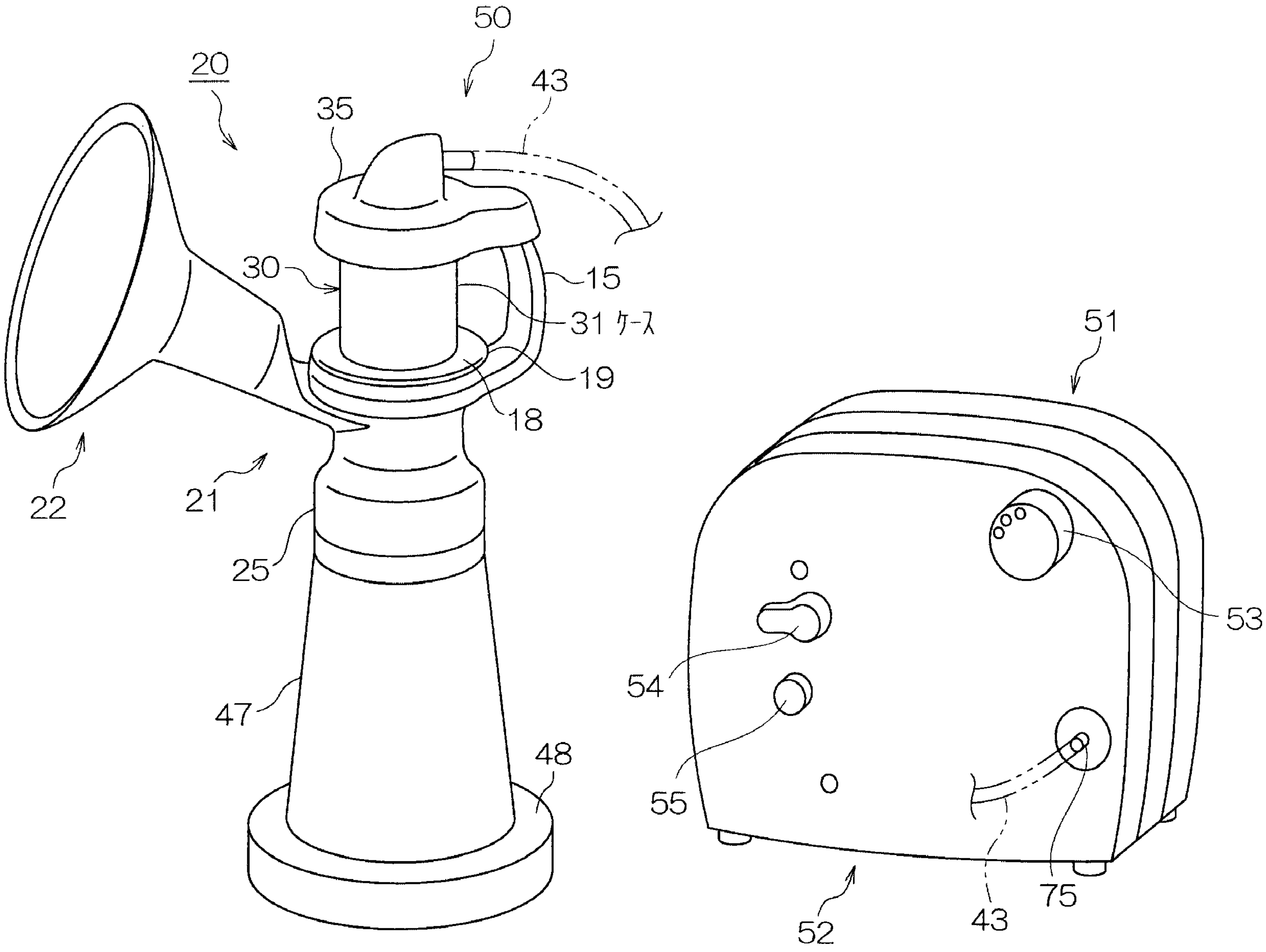


图 1

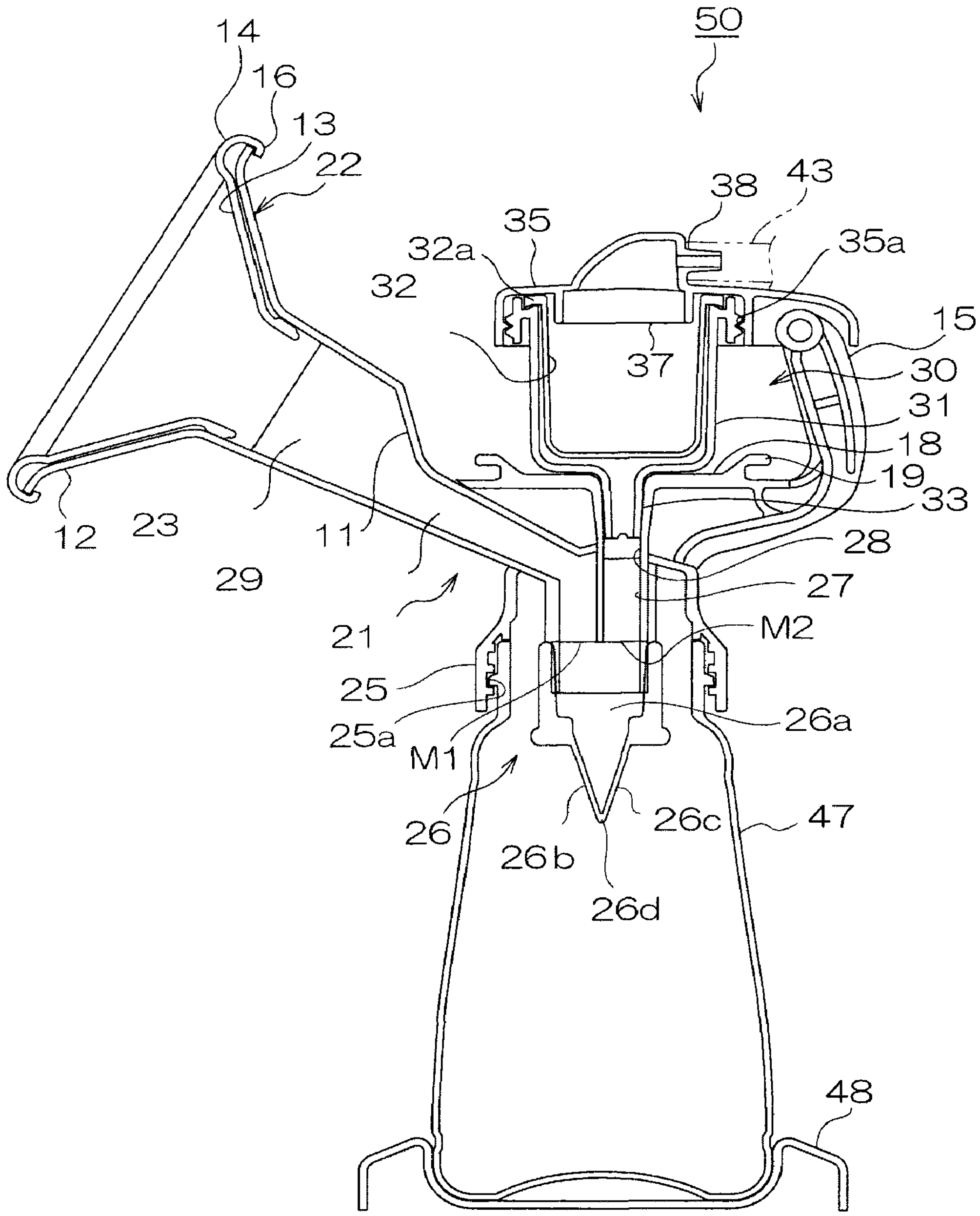

50
14
16
13
22
38
43
35
35a
32a
32
15
30
31
18
19
33
28
27
M2
37
12
23
11
29
21
25
25a
M1
26a
26
26c
47
26b
26d
48

图 2

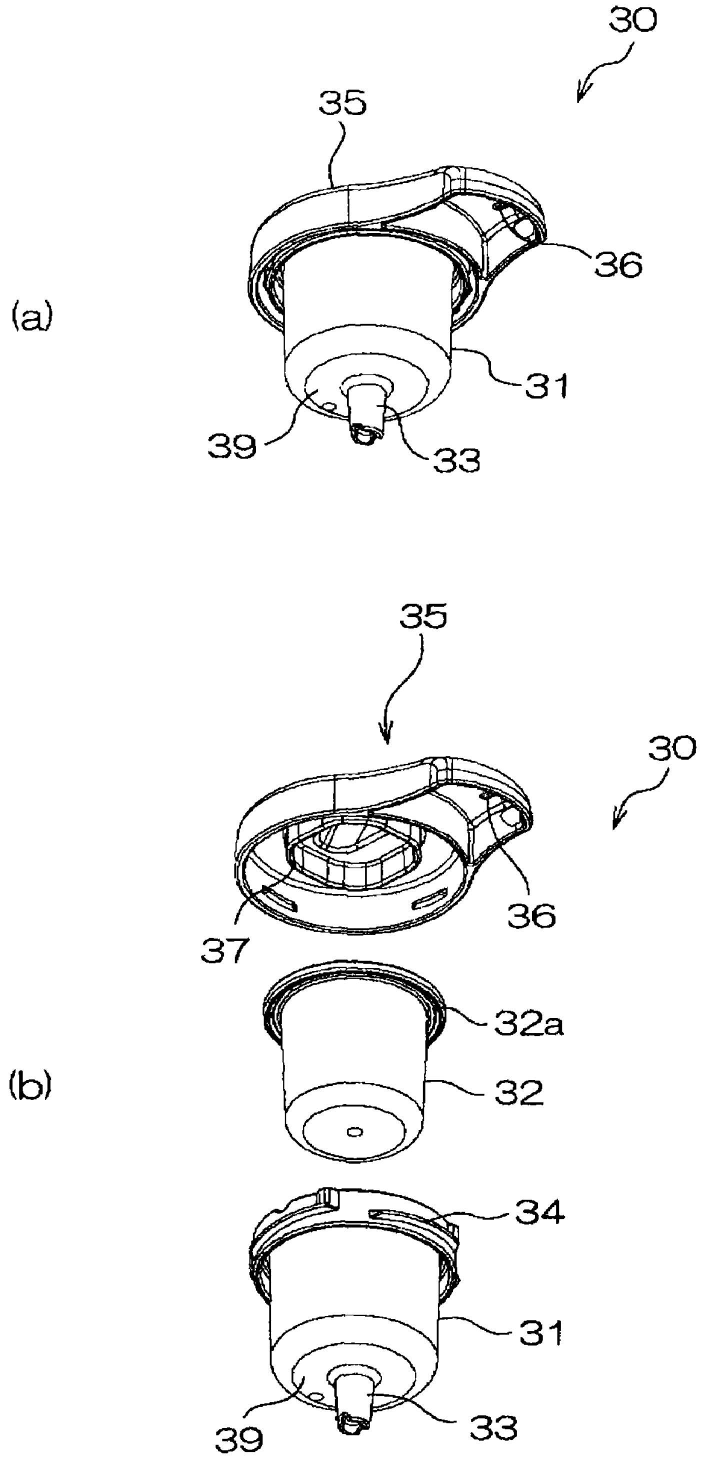


图 3

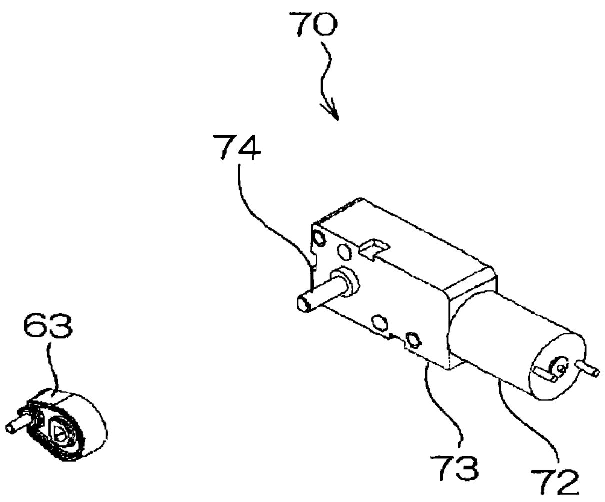


图 4

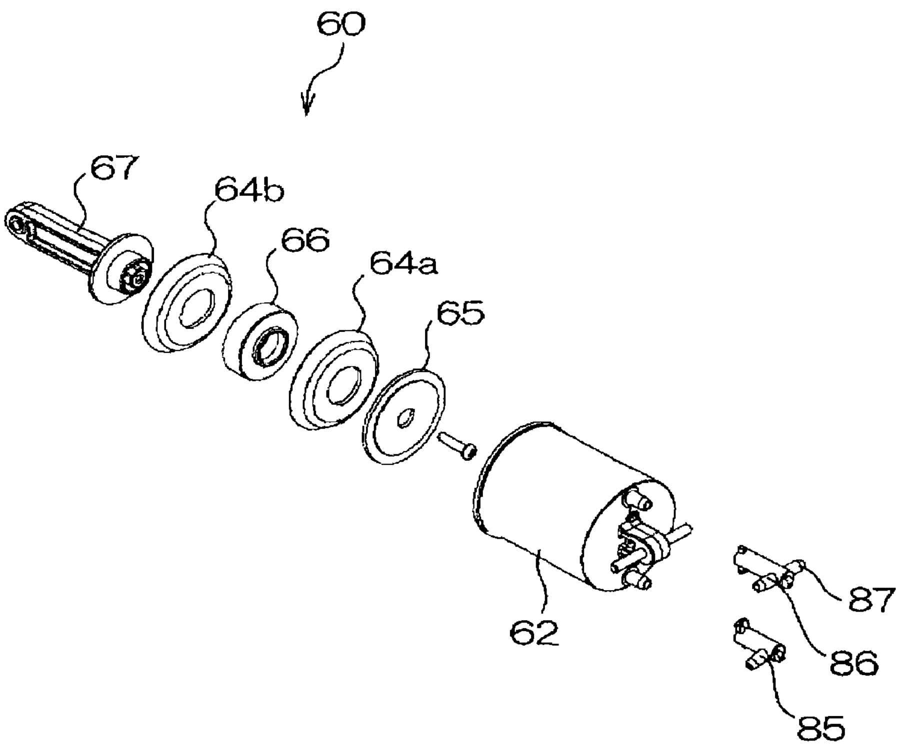


图 5

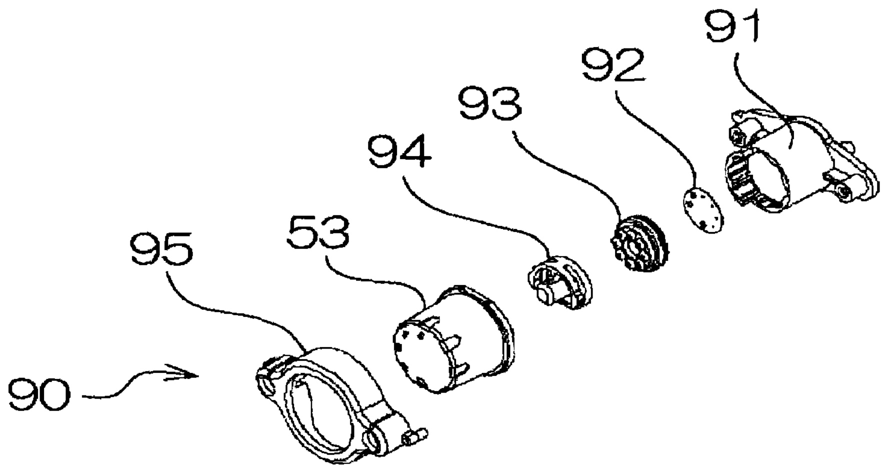


图 6

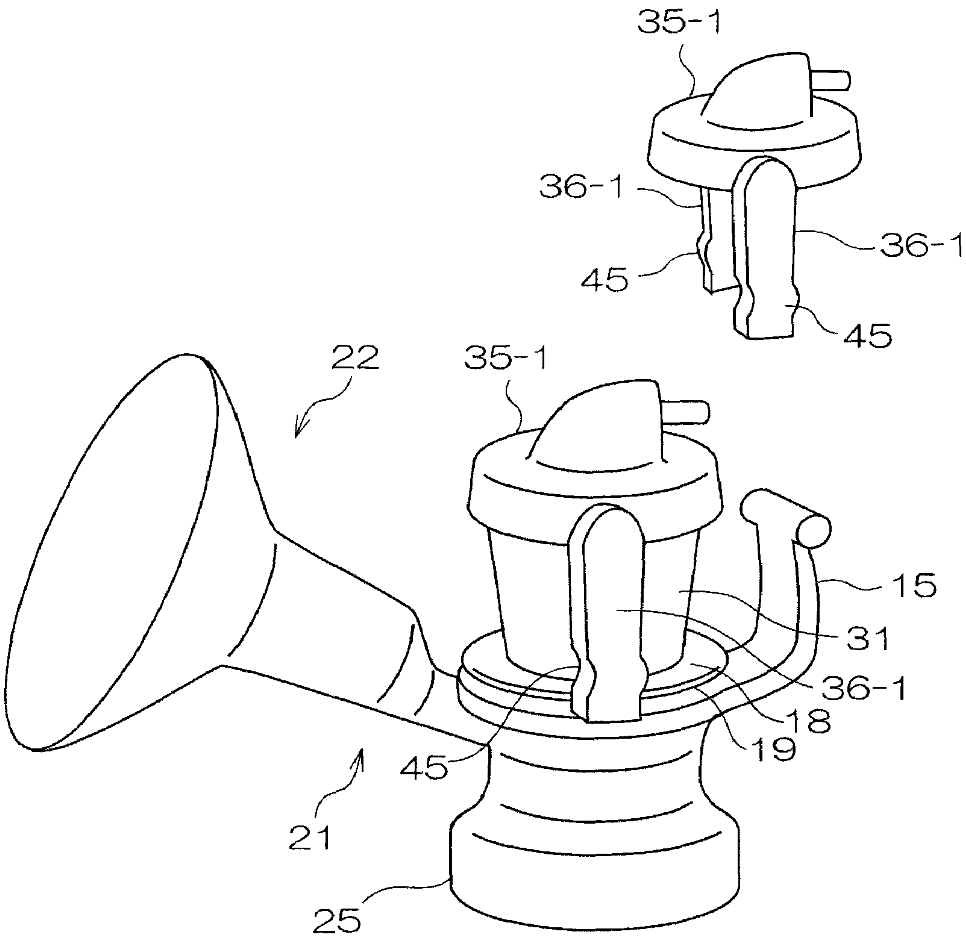


图 7

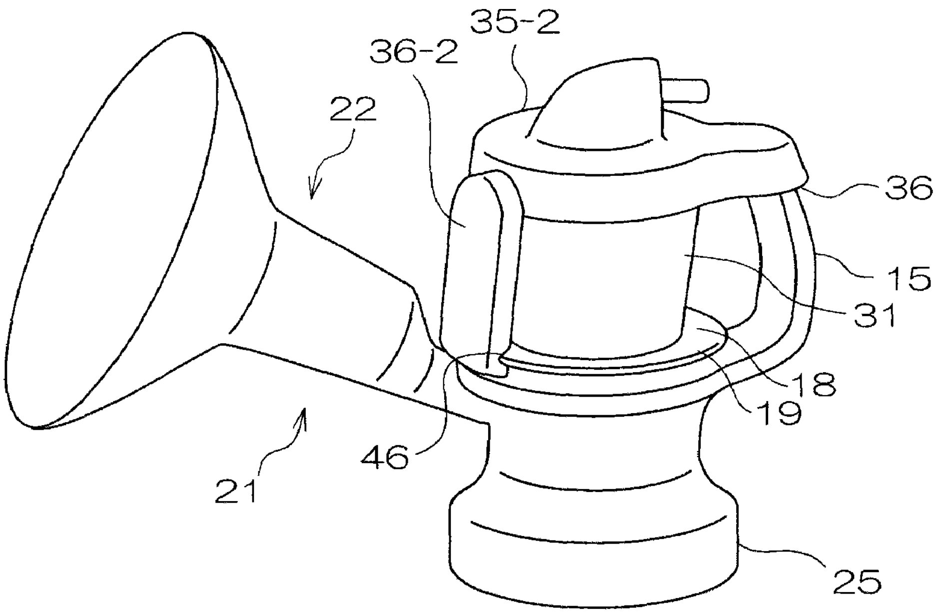
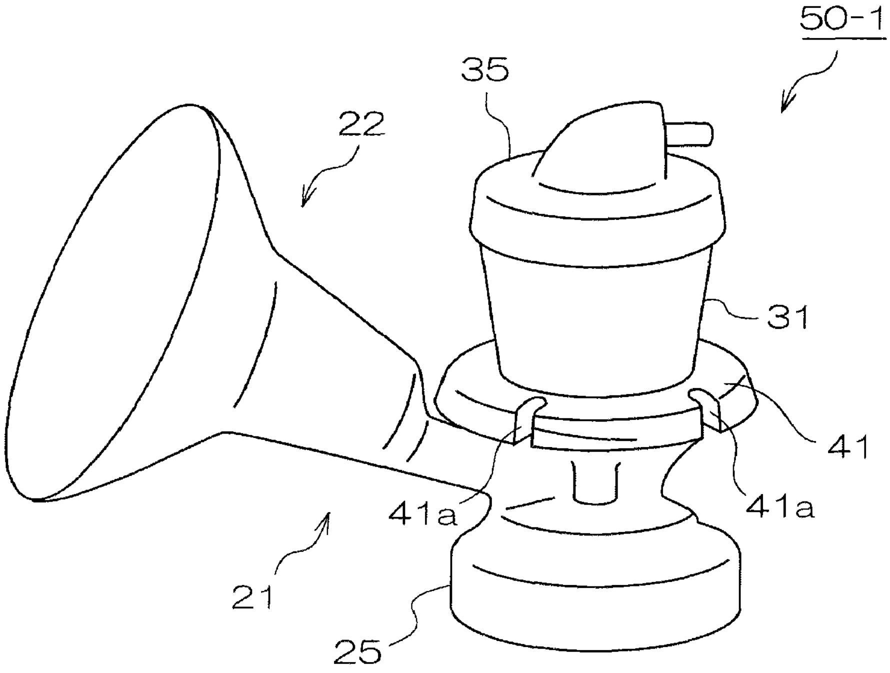


图 8

(a)



(b)

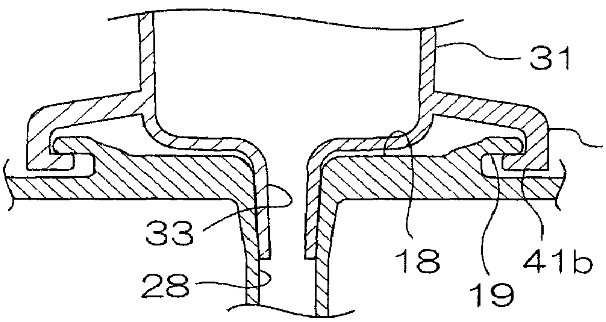


图 9

(12) UK Patent (19) GB (11) 2 435 617 (13) B

(45) Date of publication: **05.03.2008**

(54) Title of the invention: Breast pump

(51) INT CL: ***A61M 1/06*** (2006.01)

(21) Application No: **0710532.3**

(22) Date of Filing: **05.08.2004**

Date Lodged: **01.06.2007**

(30) Priority Data:
(31) **10637979** (32) **08.08.2003** (33) **US**

(62) Divided from Application No
0602539.9 under Section 15(4) of the Patents Act 1977

(43) Date A Publication: **05.09.2007**

(52) UK CL (Edition X):
N0T CLASSIFIED

(56) Documents Cited:
GB 2418865 A
US 6109100 A
US 20050043677 A1

(58) Field of Search:
As for published application 2435617 A *viz:*
UK CL (Edition X) **A5R**
INT CL **A61M**
Other
ONLINE: WPI, EPODOC
updated as appropriate

Additional Fields
UK CL (Edition X) **A5R**
INT CL **A61M**
Other
ONLINE: WPI, EPODOC

(72) Inventor(s):
Christopher Kampf
Aidan Petrie
Michael Pereira
Charles J Renz
David Robson
Marco Wo

(73) Proprietor(s):
Playtex Products, Inc
(Incorporated in USA - Delaware)
300 Nyala Farms Road, Westport,
Connecticut 06880,
United States of America

(74) Agent and/or Address for Service:
Keltie
Fleet Place House, 2 Fleet Place, LONDON,
EC4M 7ET, United Kingdom

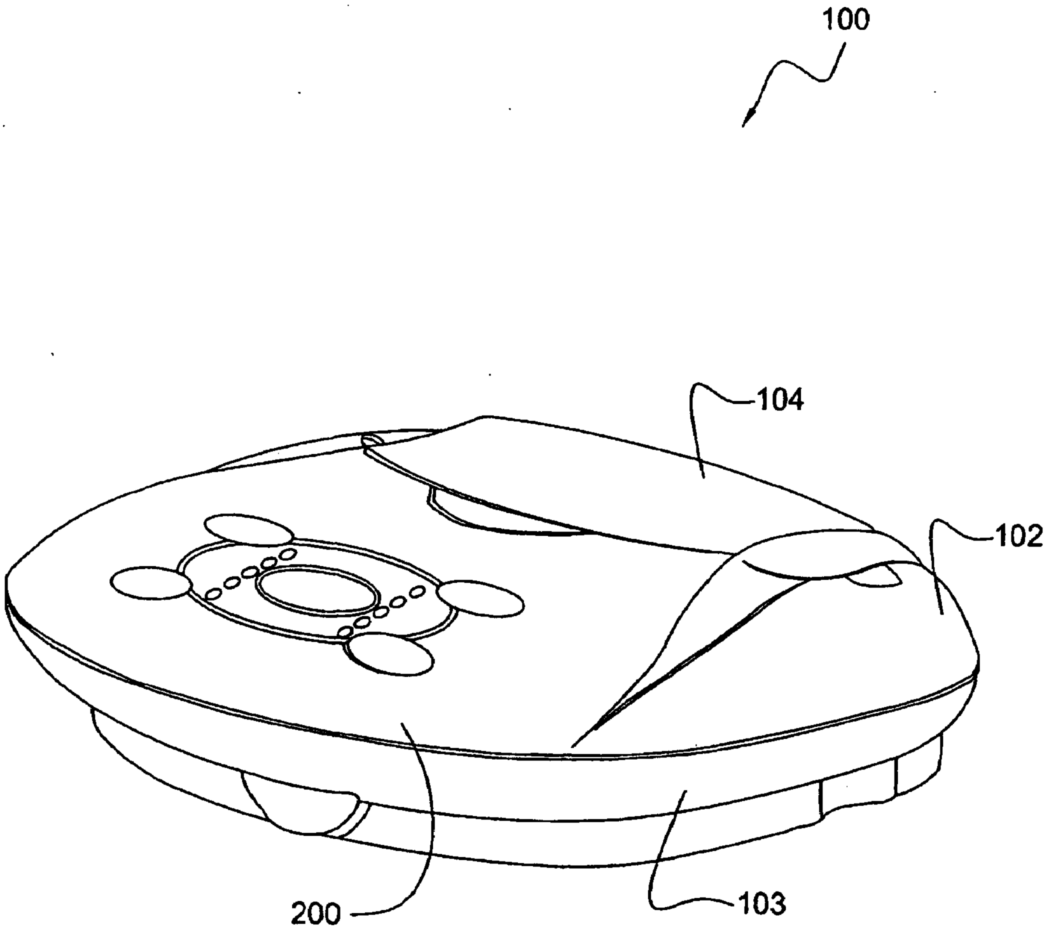


Fig. 1

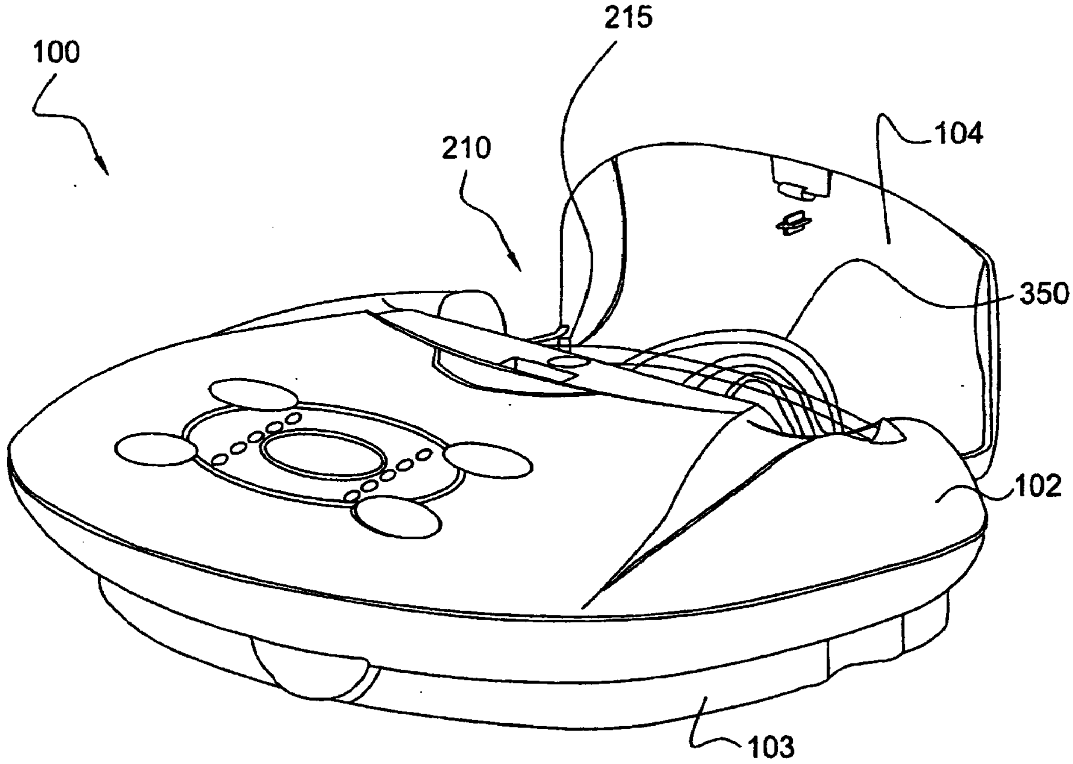


Fig. 2

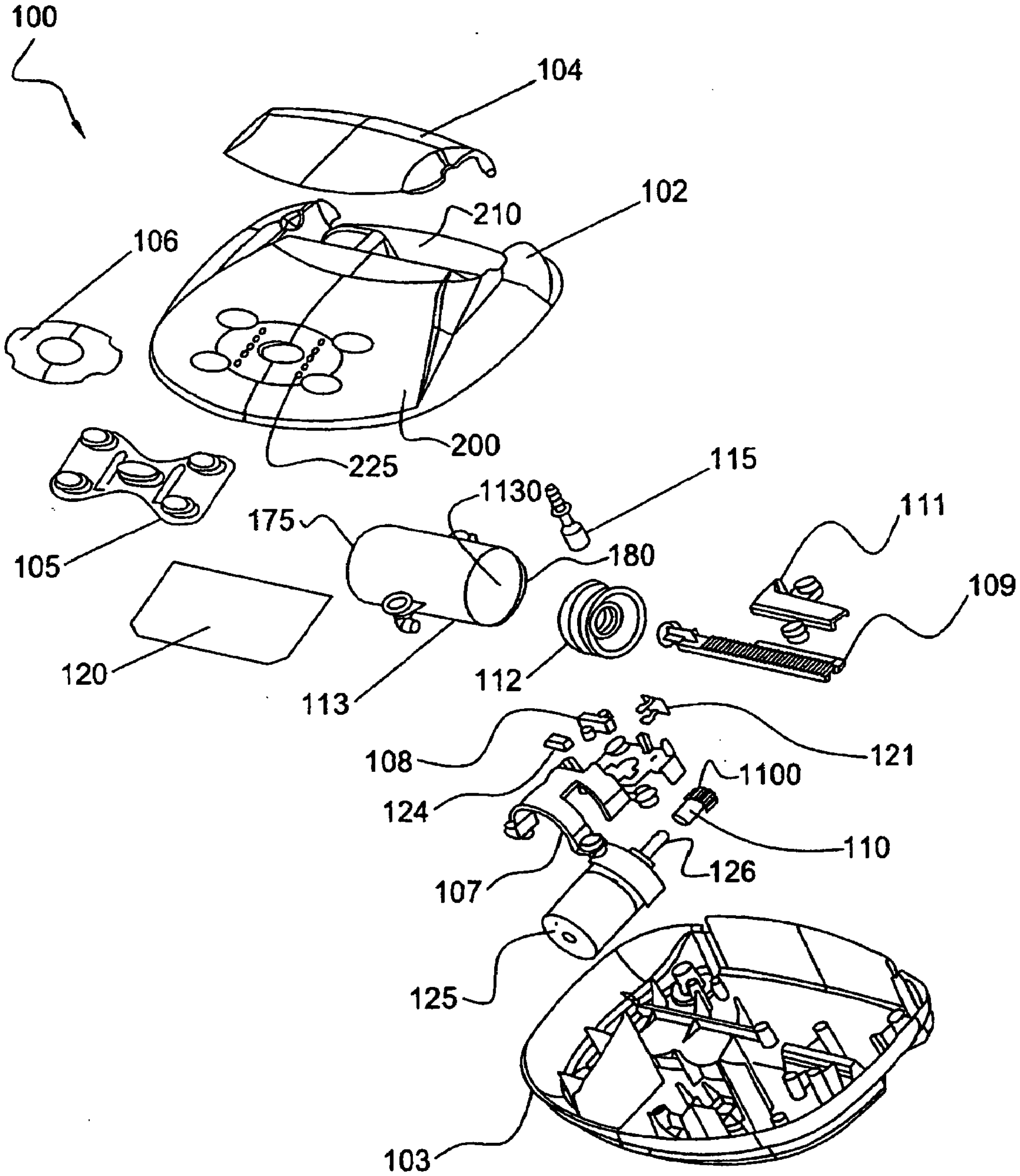

100
104
102
210
106
200
225
115
1130
175
180
111
105
109
120
113
112
121
108
1100
124
110
126
107
125
103

Fig. 3

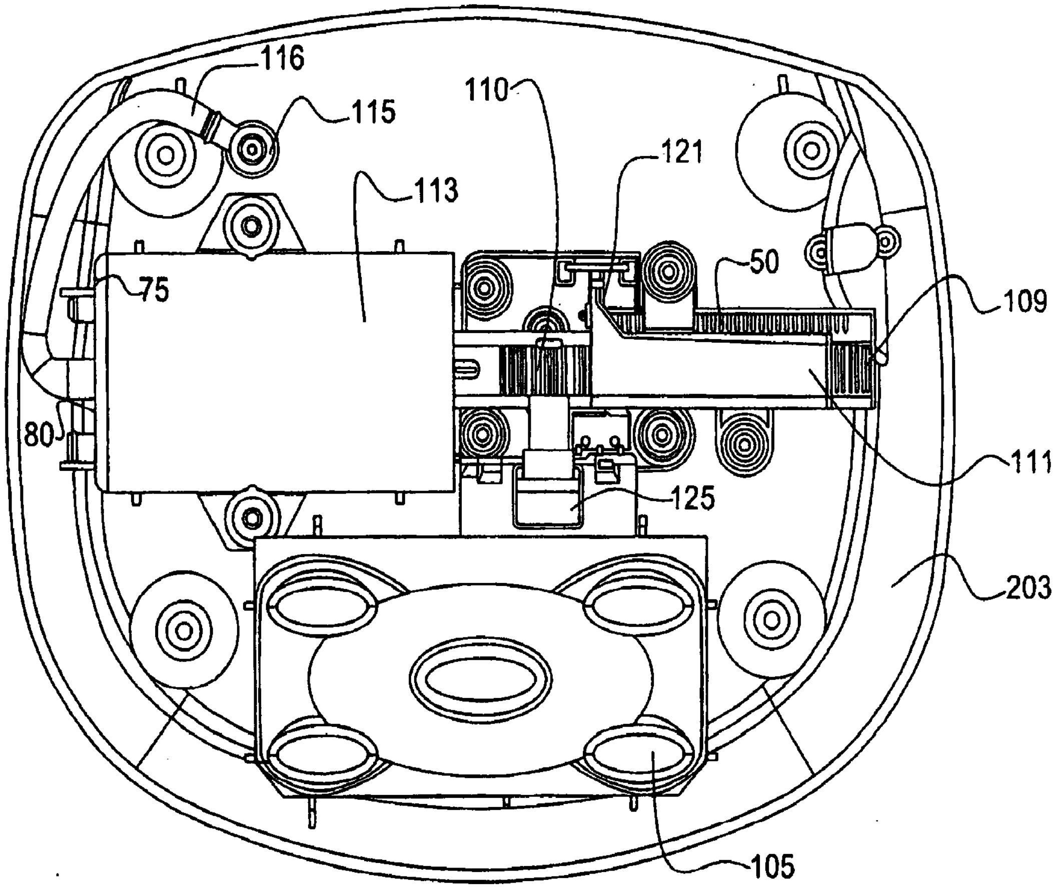


Fig. 4

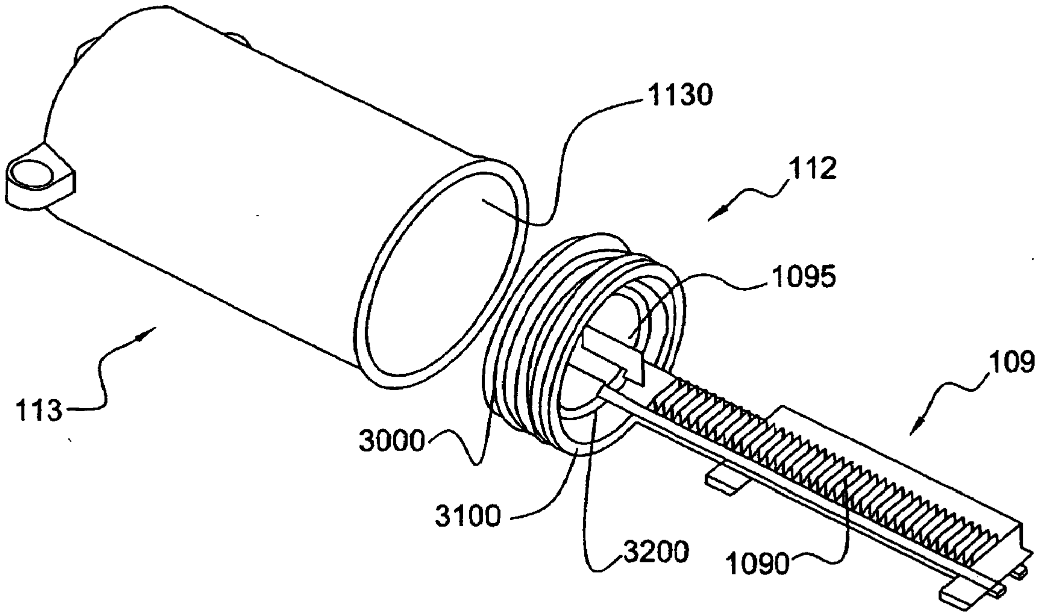

1130
112
1095
109
113
3000
3100
3200
1090

Fig. 5

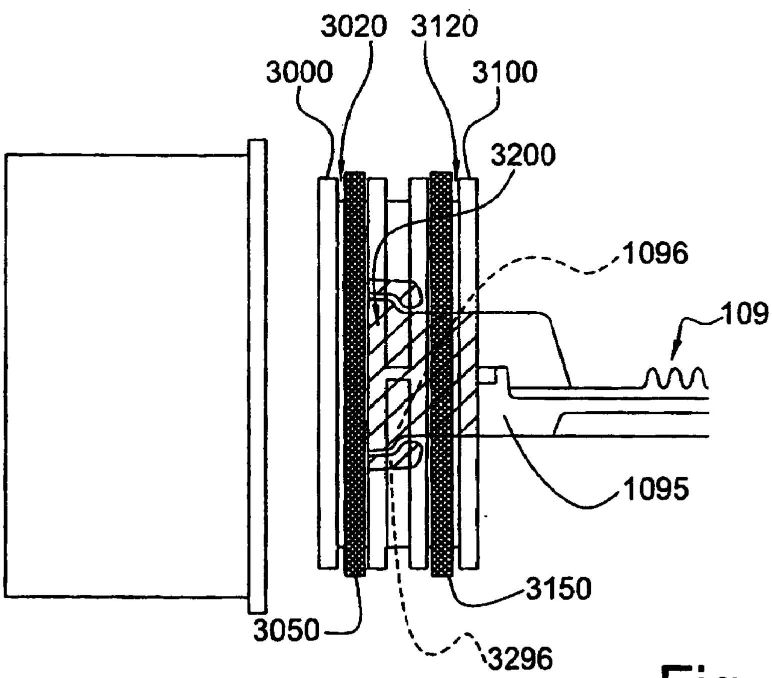

3020
3120
3000
3100
3200
1096
109
1095
3150
3050
3296

Fig. 6

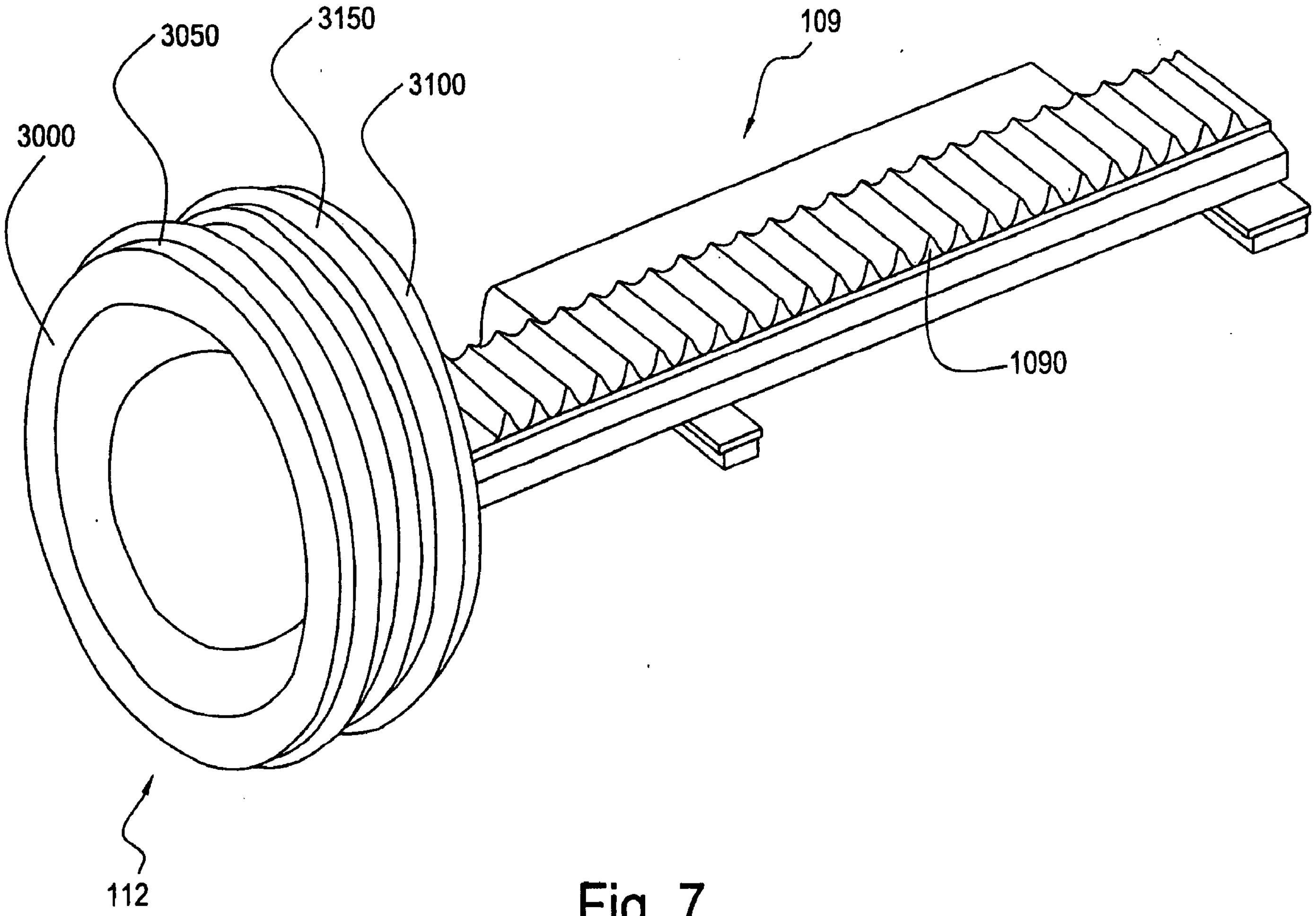


Fig. 7

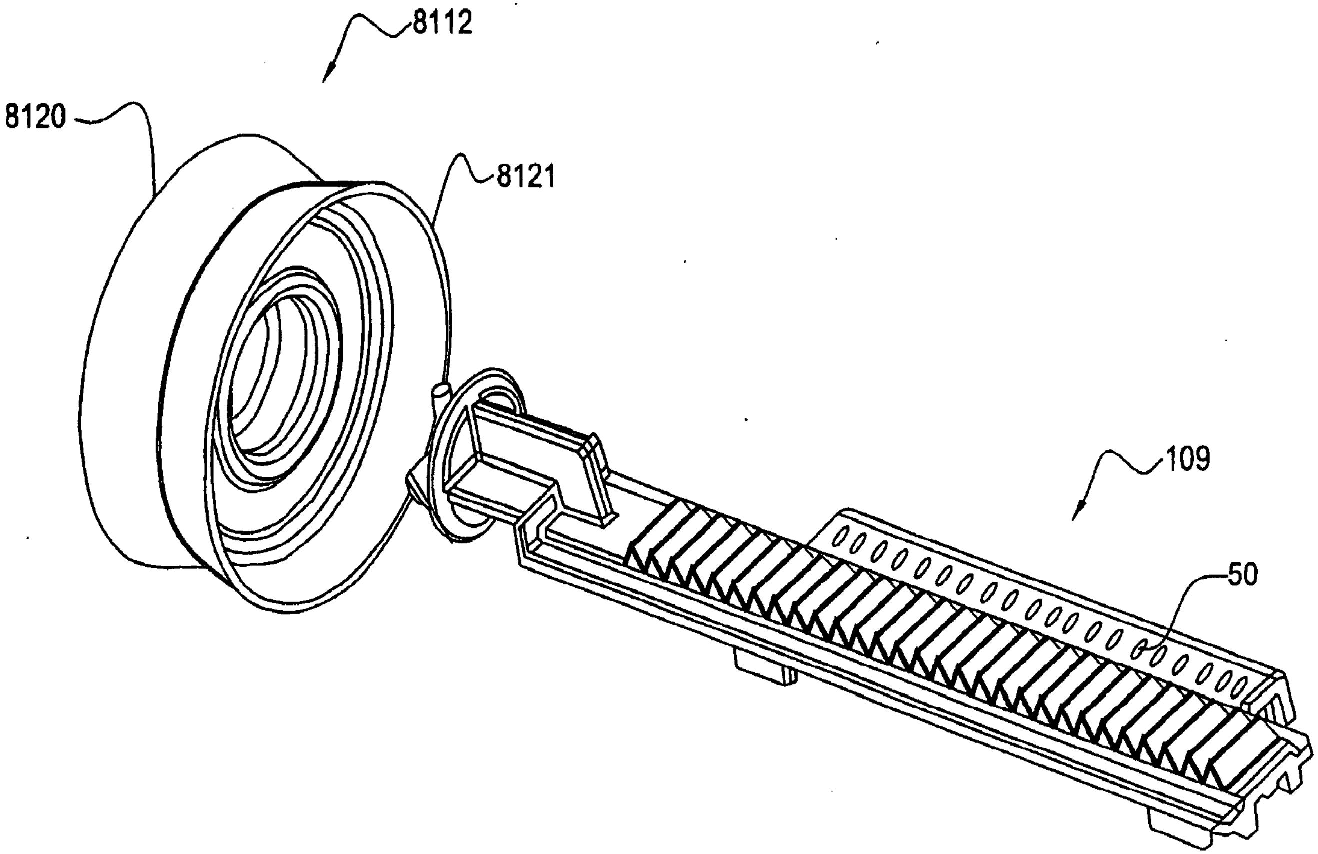


Fig. 8

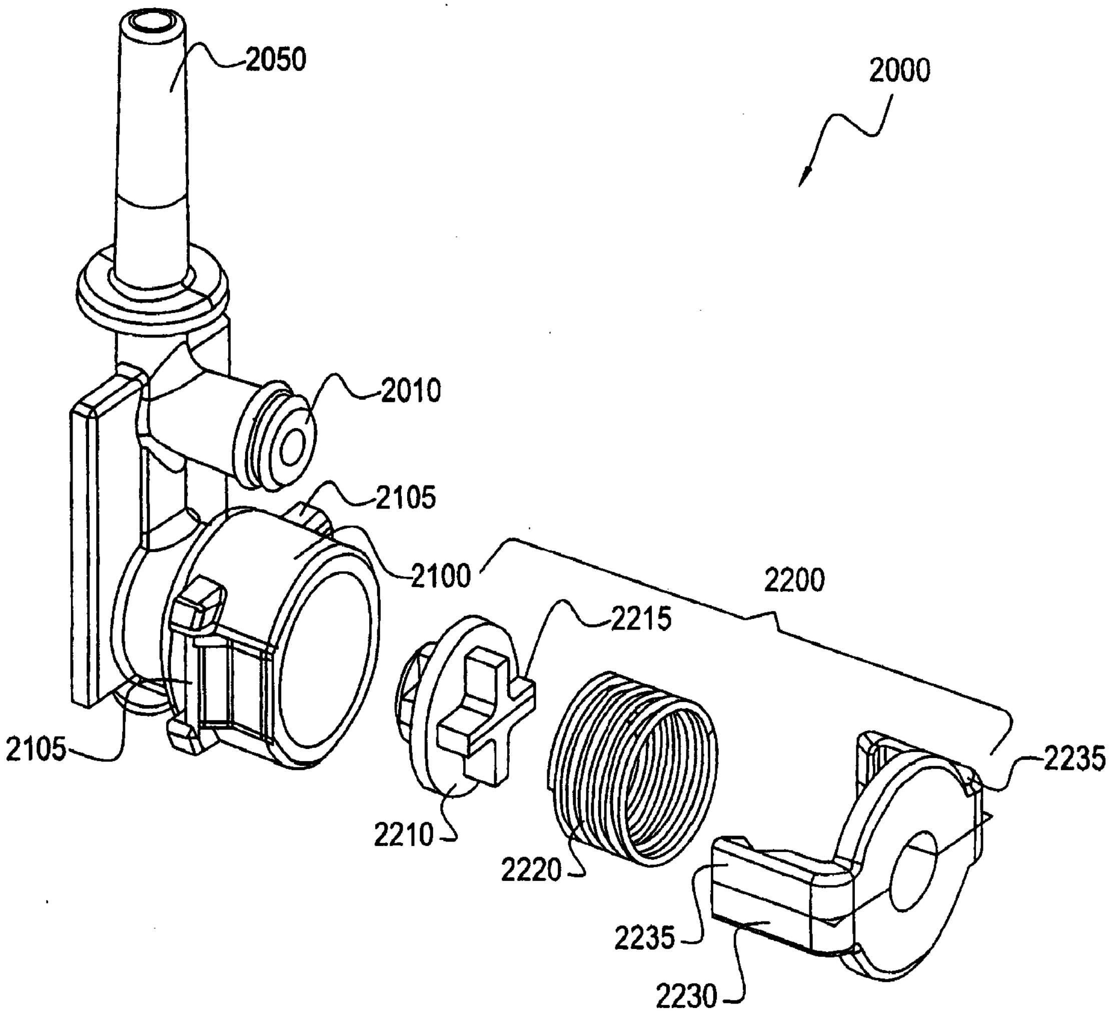

2050
2000
2010
2105
2100
2200
2215
2105
2235
2210
2220
2235
2230

Fig. 9

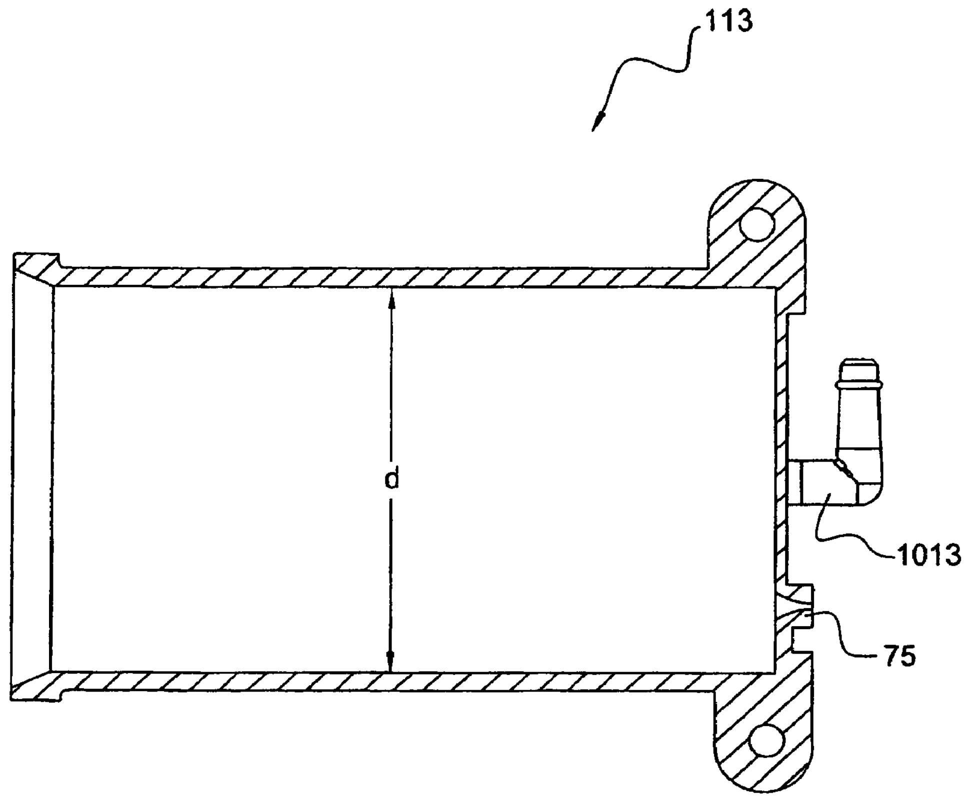


Fig. 10

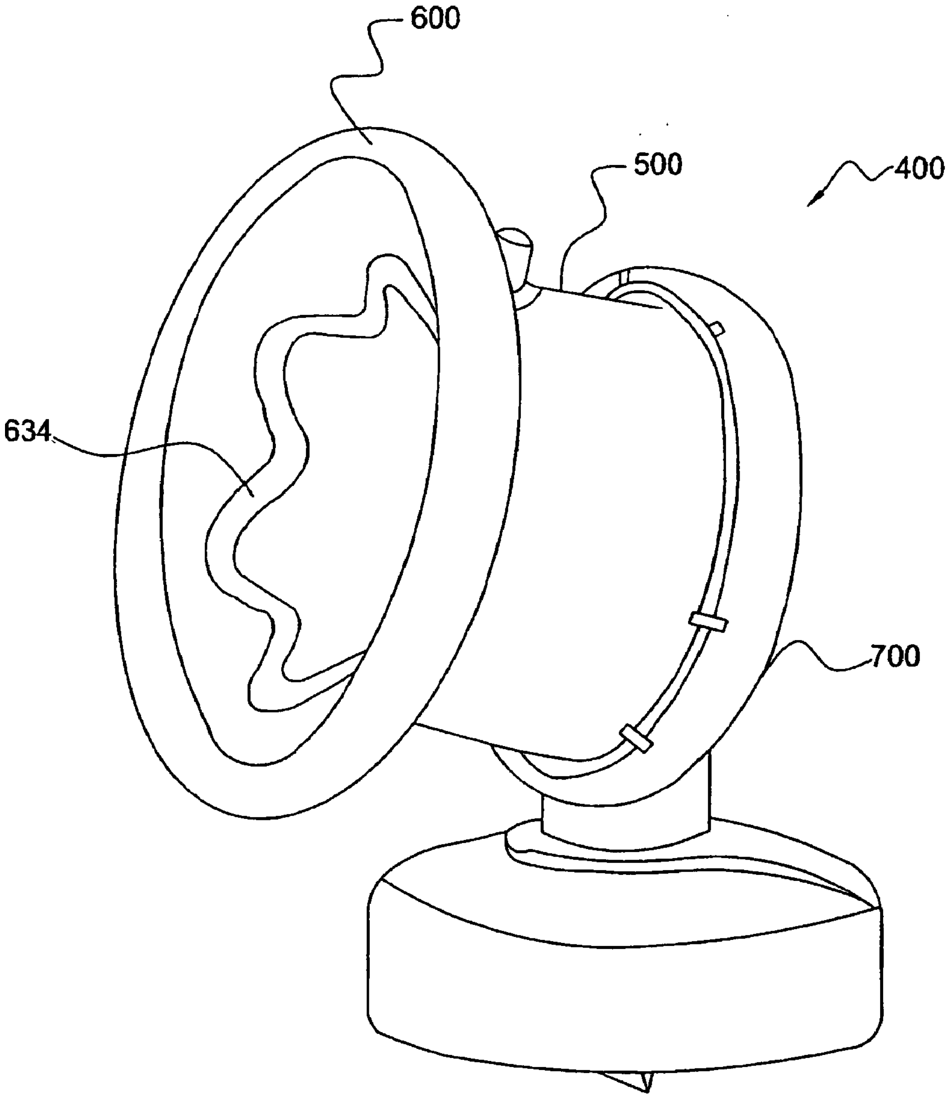


Fig. 11

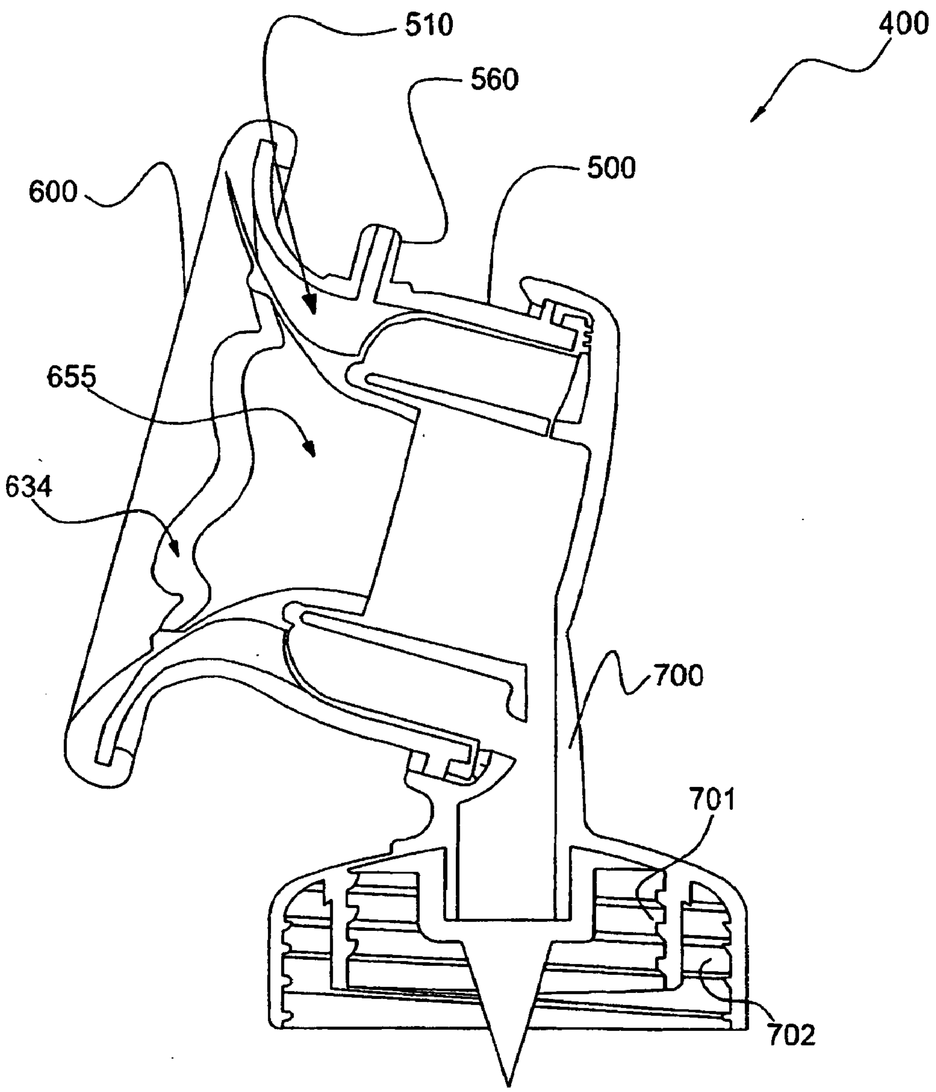


Fig. 12

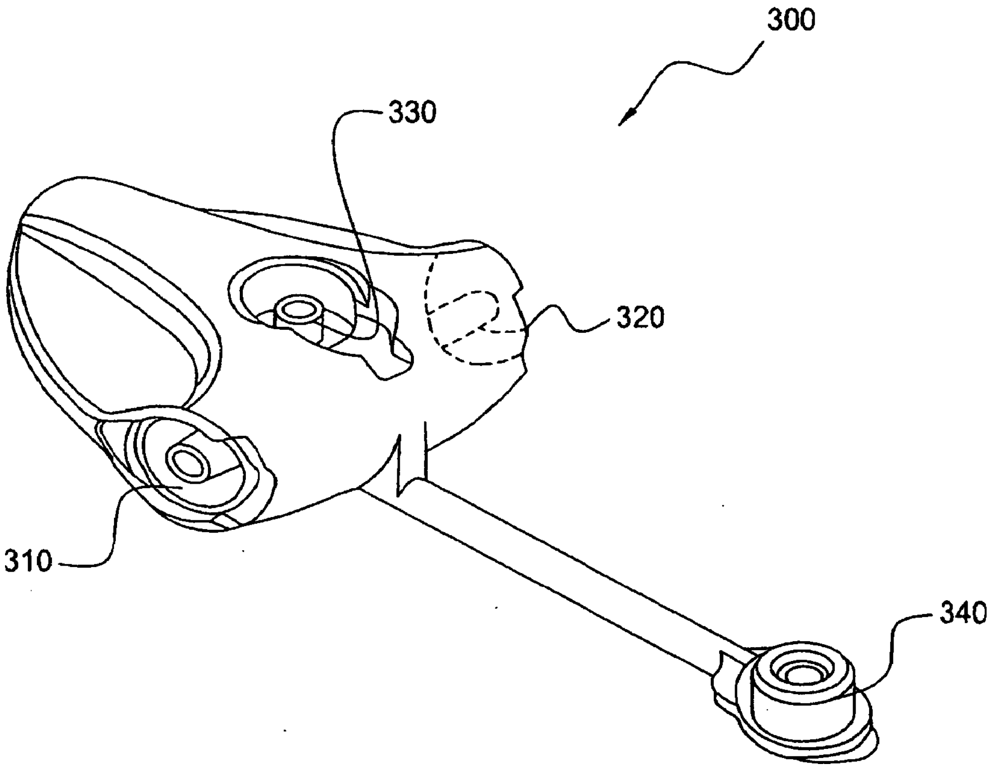


Fig. 13

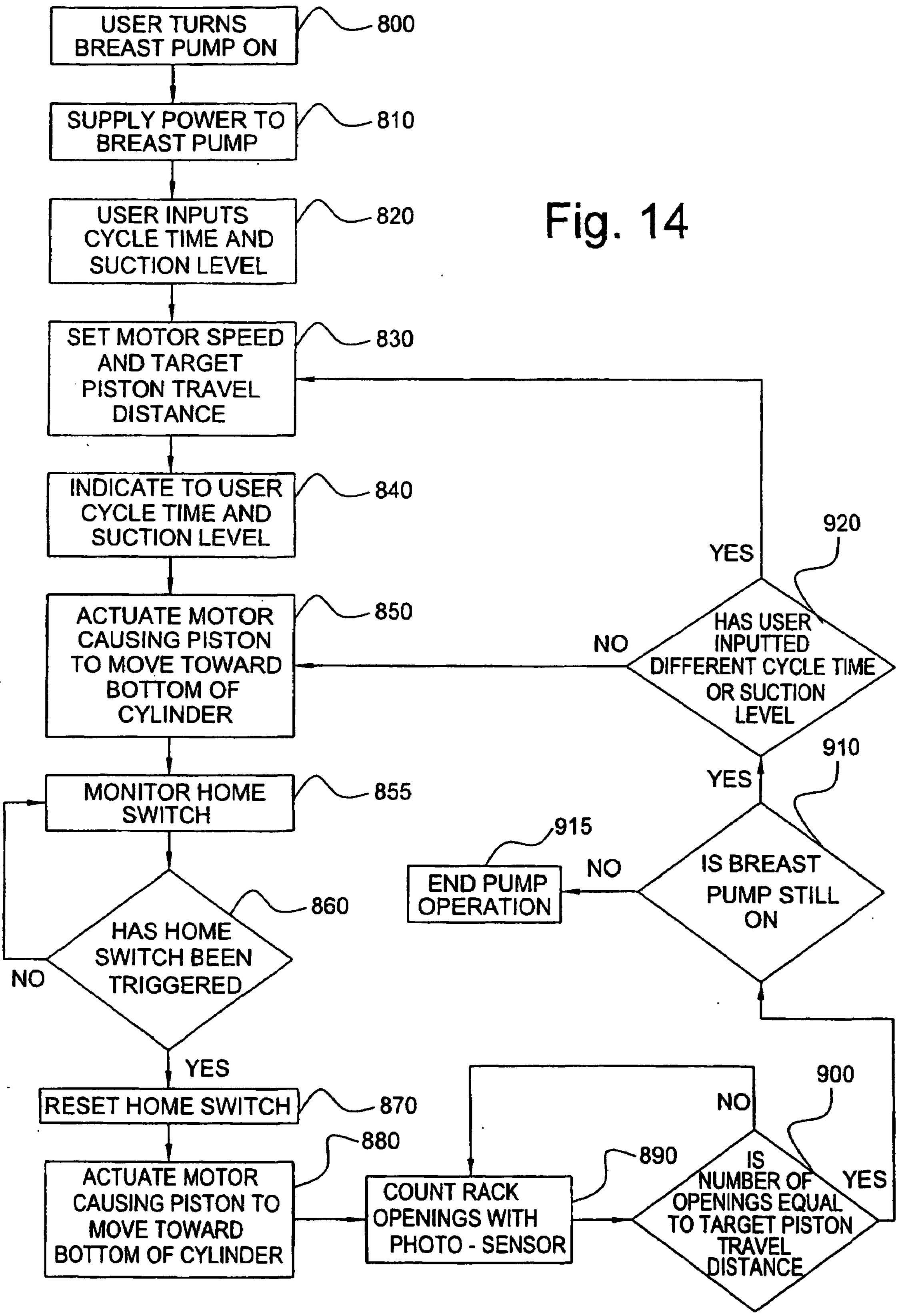

USER TURNS BREAST PUMP ON
800
SUPPLY POWER TO BREAST PUMP
810
USER INPUTS CYCLE TIME AND SUCTION LEVEL
820
SET MOTOR SPEED AND TARGET PISTON TRAVEL DISTANCE
830
INDICATE TO USER CYCLE TIME AND SUCTION LEVEL
840
ACTUATE MOTOR CAUSING PISTON TO MOVE TOWARD BOTTOM OF CYLINDER
850
MONITOR HOME SWITCH
855
HAS HOME SWITCH BEEN TRIGGERED
860
NO
YES
RESET HOME SWITCH
870
ACTUATE MOTOR CAUSING PISTON TO MOVE TOWARD BOTTOM OF CYLINDER
880
COUNT RACK OPENINGS WITH PHOTO - SENSOR
890
IS NUMBER OF OPENINGS EQUAL TO TARGET PISTON TRAVEL DISTANCE
900
NO
YES
IS BREAST PUMP STILL ON
910
NO
YES
END PUMP OPERATION
915
HAS USER INPUTTED DIFFERENT CYCLE TIME OR SUCTION LEVEL
920
NO
YES

Fig. 14

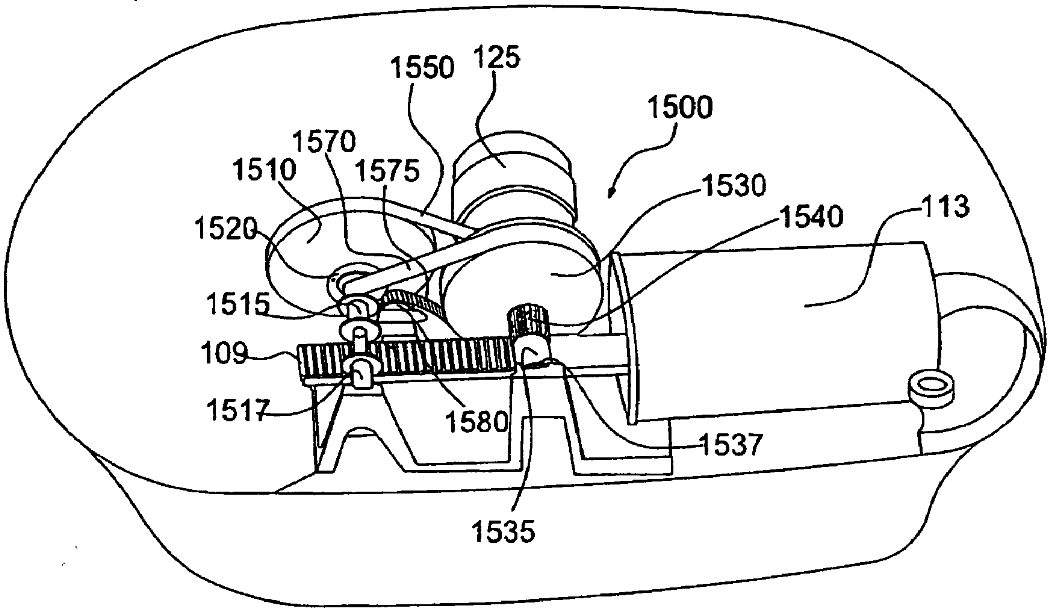

1550
125
1500
1570
1510
1575
1530
1540
113
1520
1515
109
1517
1580
1537
1535

Fig. 15

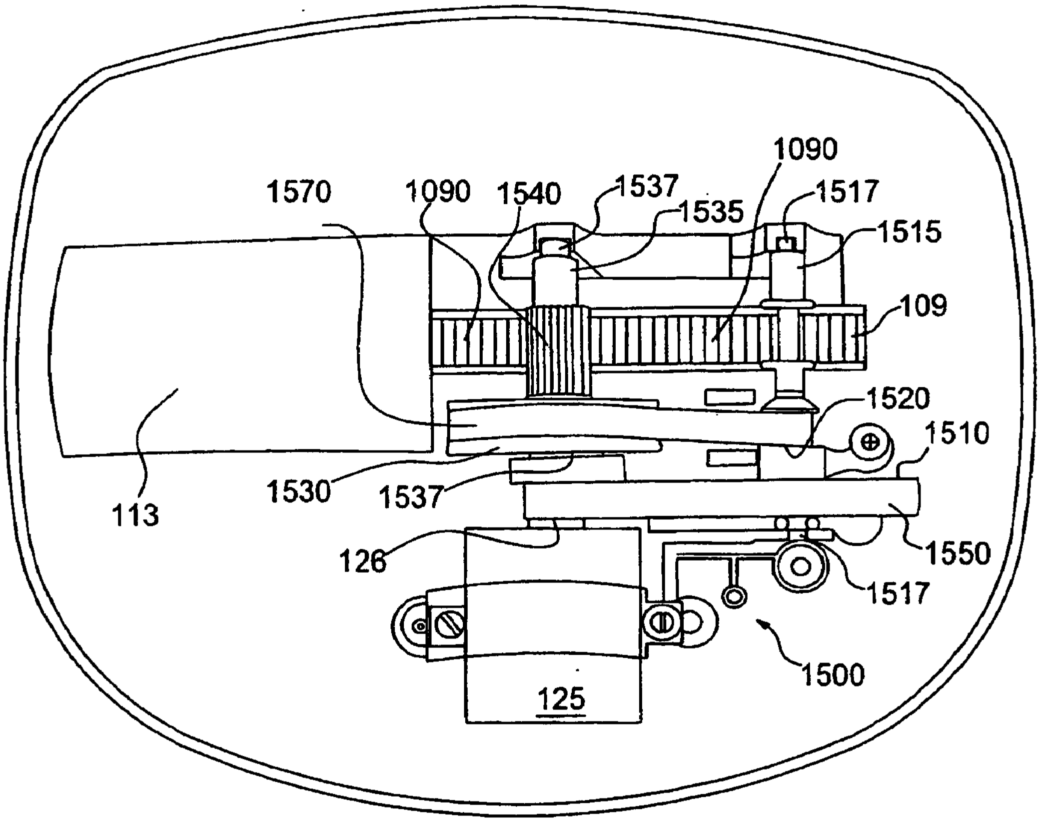

1090
1570
1090
1540
1537
1535
1517
1515
109
1520
1510
113
1530
1537
1550
126
1517
1500
125

Fig. 16

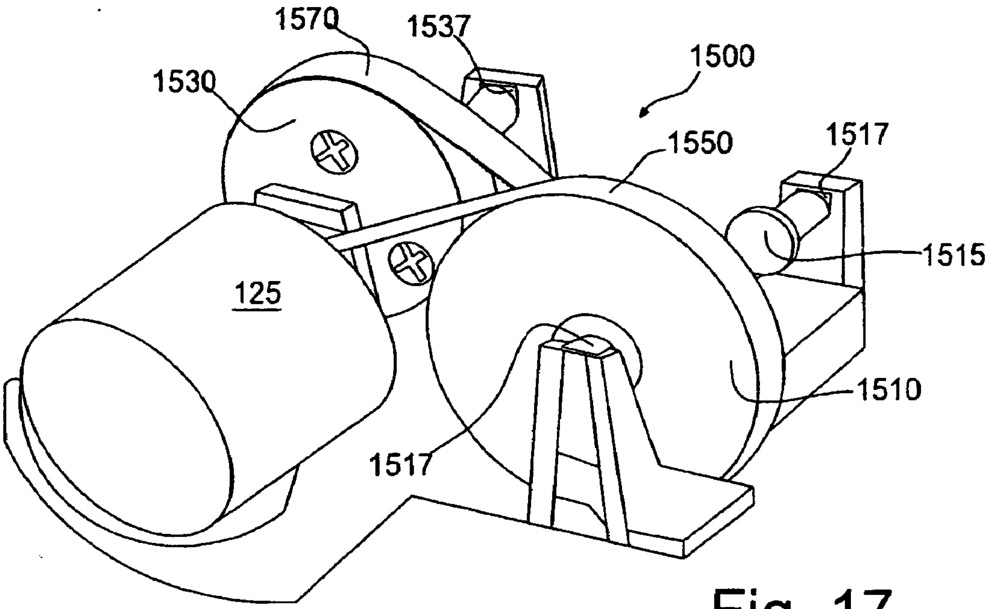

1570
1537
1500
1530
1550
1517
1515
125
1510
1517

Fig. 17

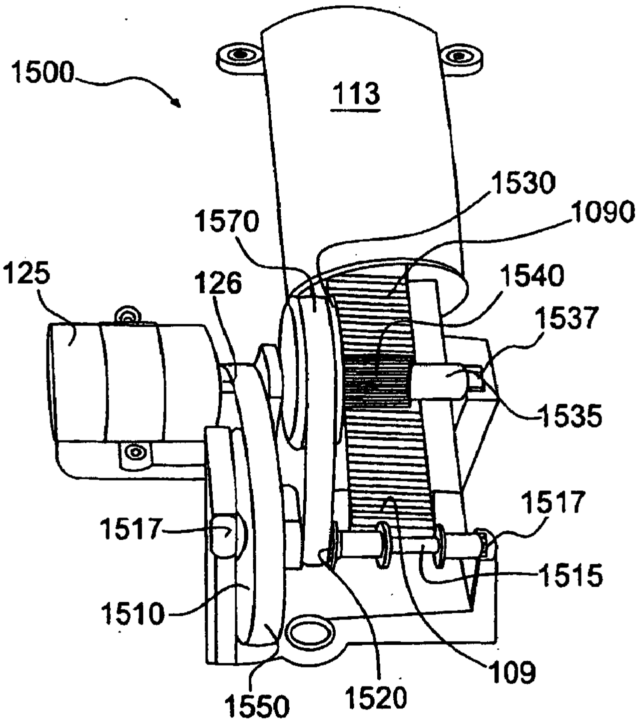

1500
113
1530
1090
1570
1540
125
126
1537
1535
1517
1517
1515
1510
109
1550
1520

Fig. 18

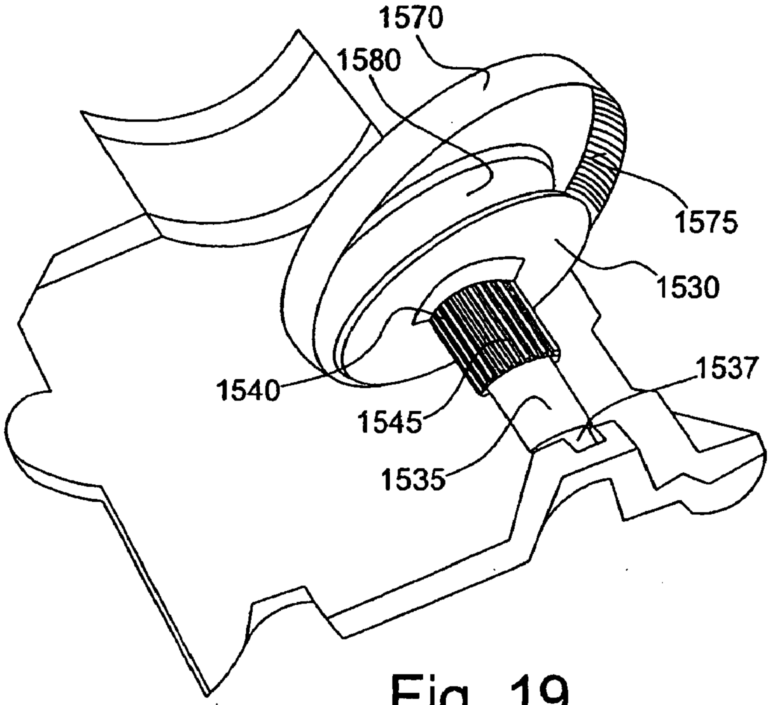

1570
1580
1575
1530
1537
1540
1545
1535

Fig. 19

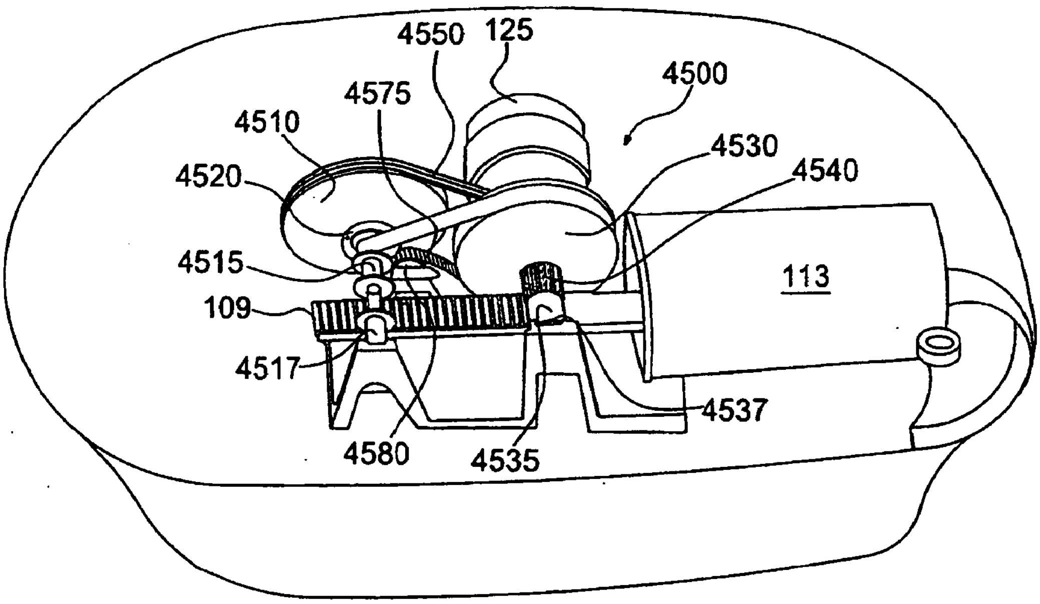

4550
125
4500
4575
4510
4520
4530
4540
4515
109
113
4517
4537
4580
4535

Fig. 20

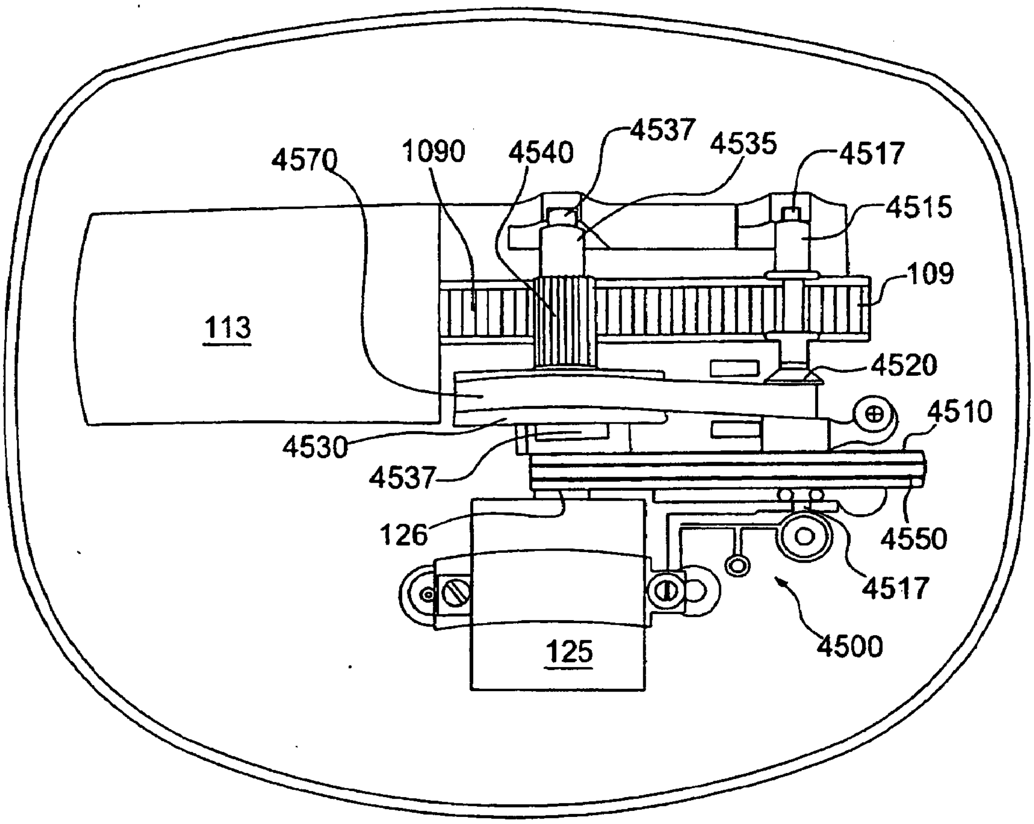

4570
1090
4540
4537
4535
4517
4515
109
113
4520
4510
4530
4537
126
4550
4517
125
4500

Fig. 21

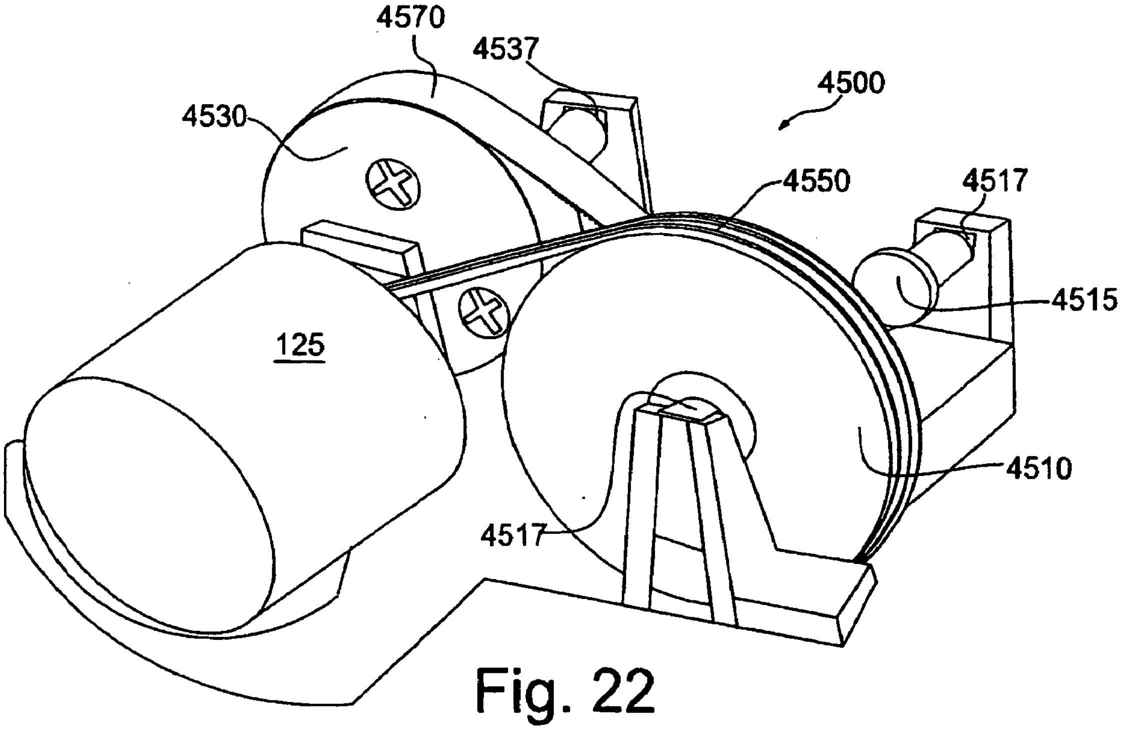

4570
4537
4500
4530
4550
4517
4515
125
4510
4517

Fig. 22

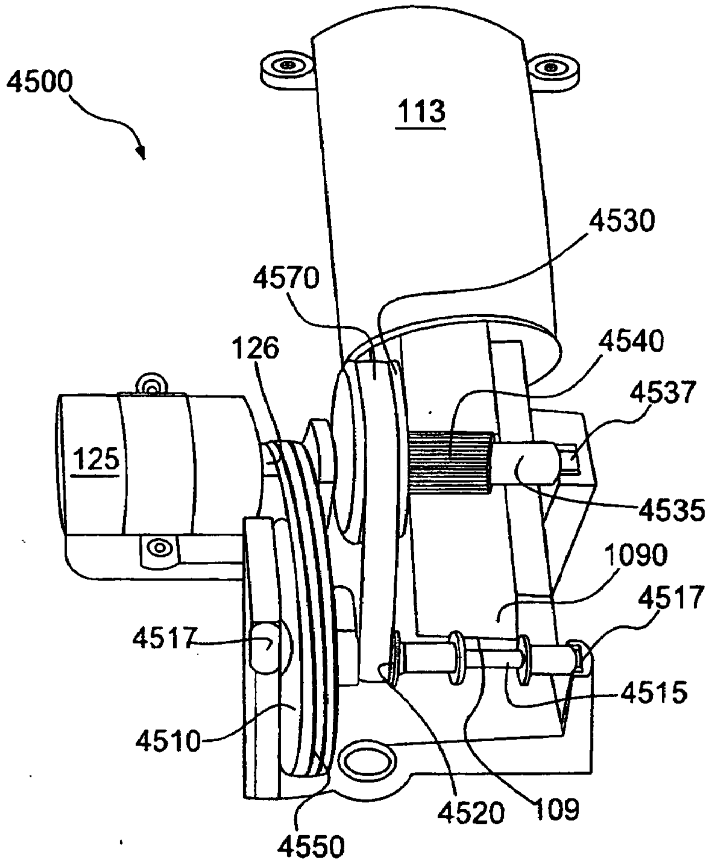

4500
113
4530
4570
4540
126
4537
125
4535
1090
4517
4517
4515
4510
4520
109
4550

Fig. 23

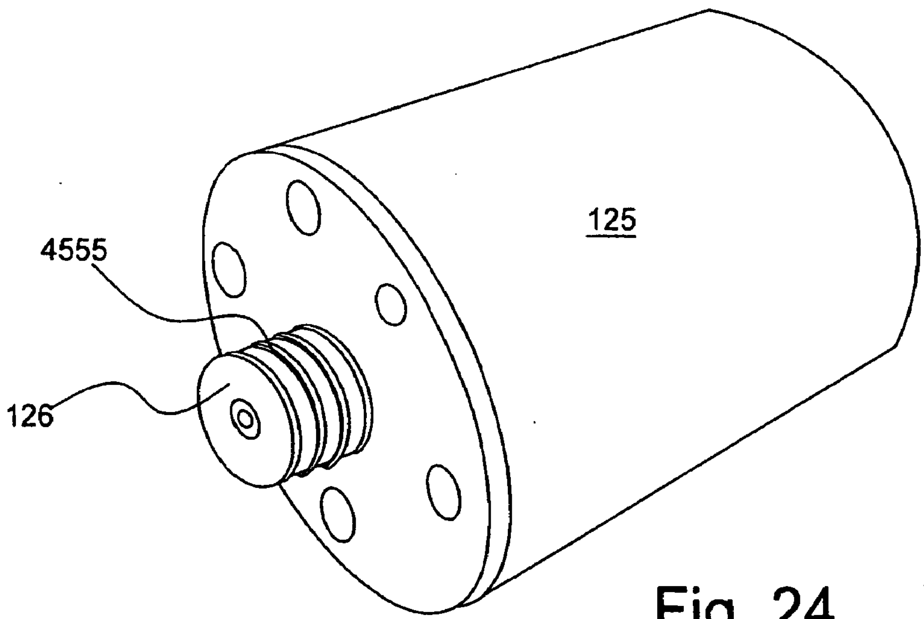

125
4555
126

Fig. 24

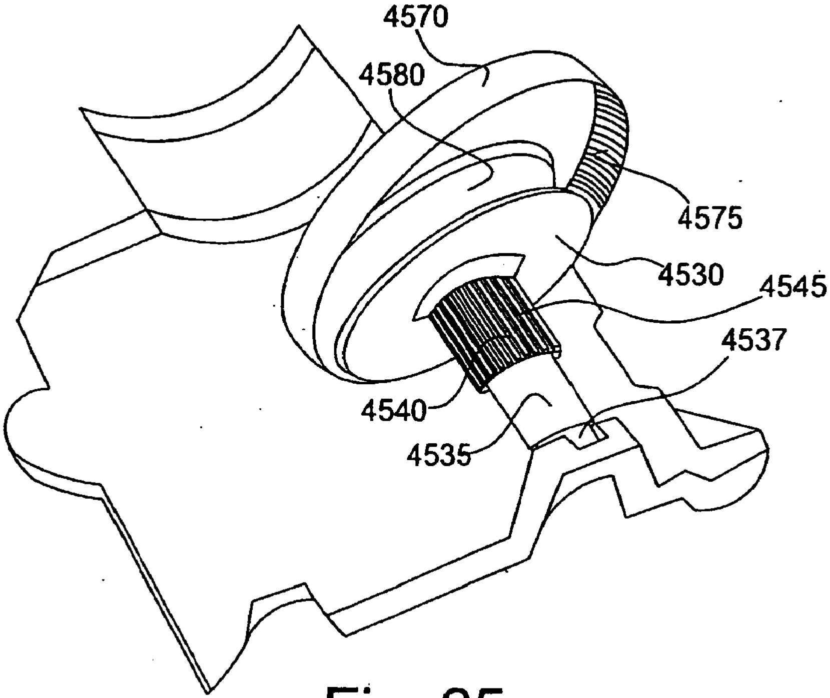

4570
4580
4575
4530
4545
4537
4540
4535

Fig. 25

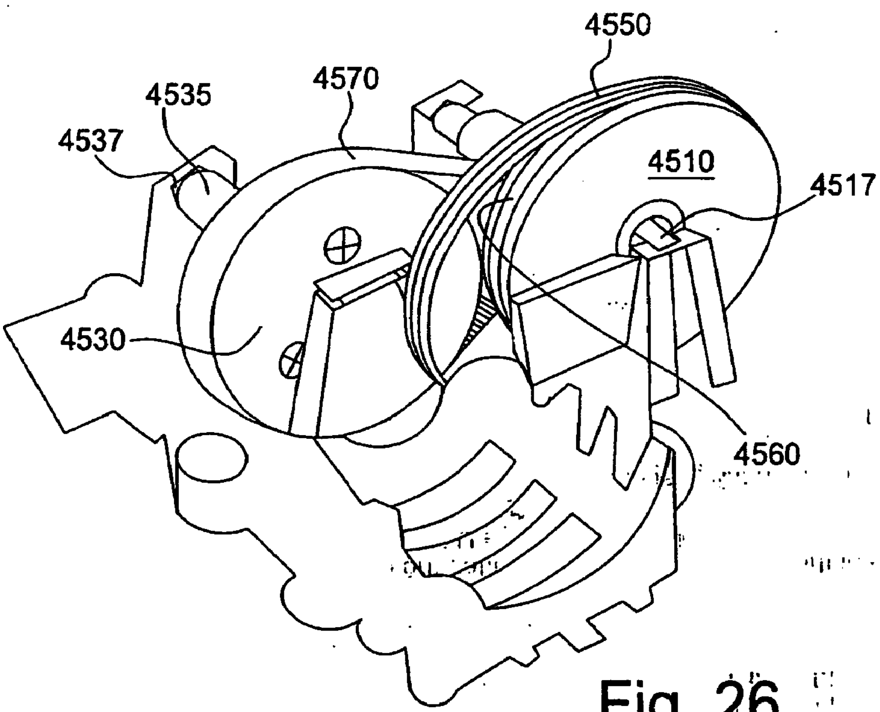

4550
4570
4535
4537
4510
4517
4530
4560

Fig. 26

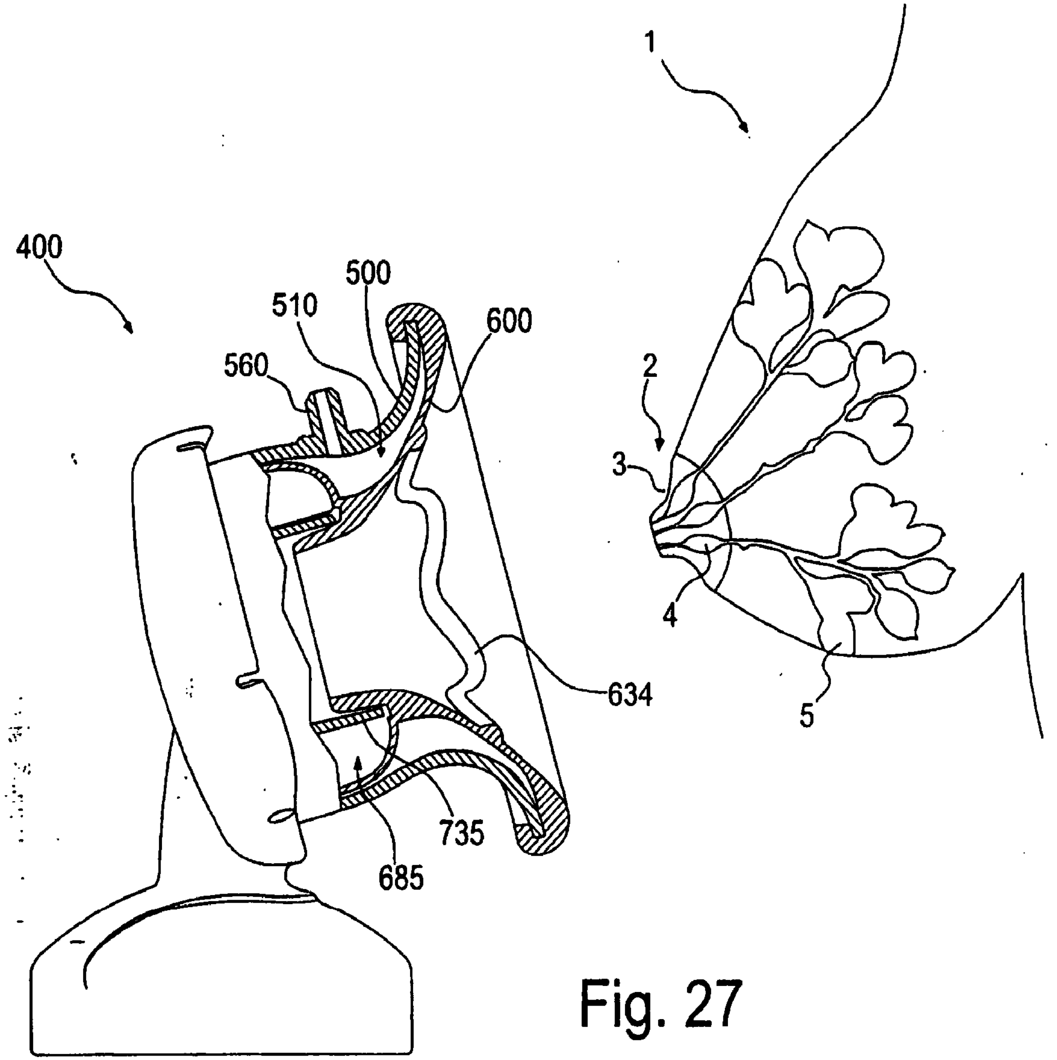


Fig. 27

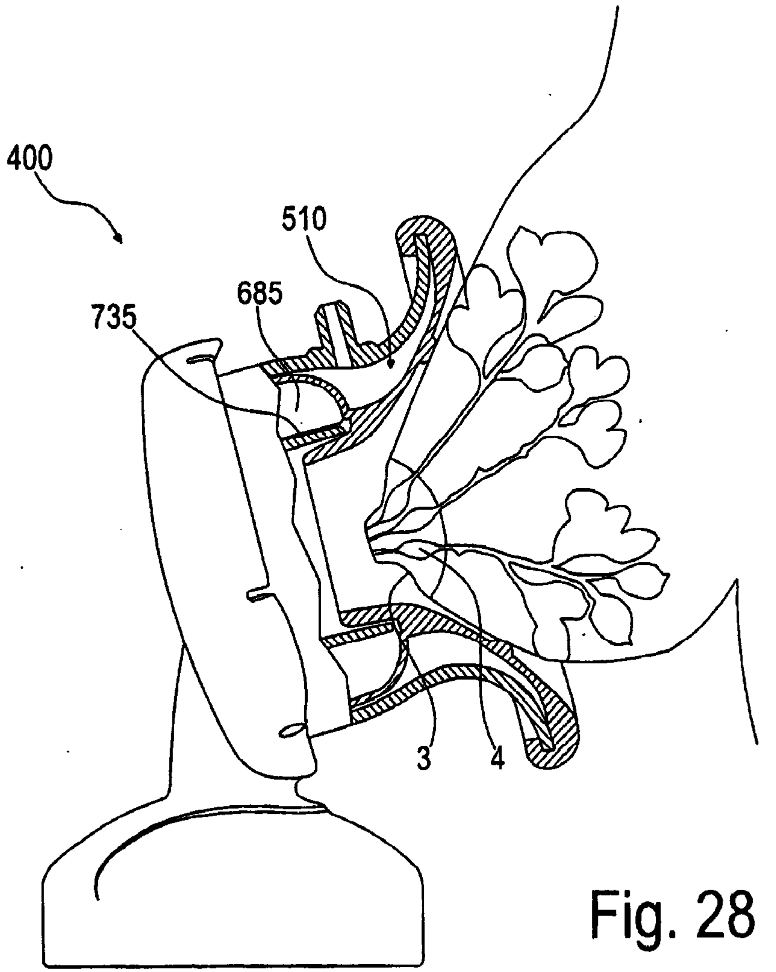


Fig. 28

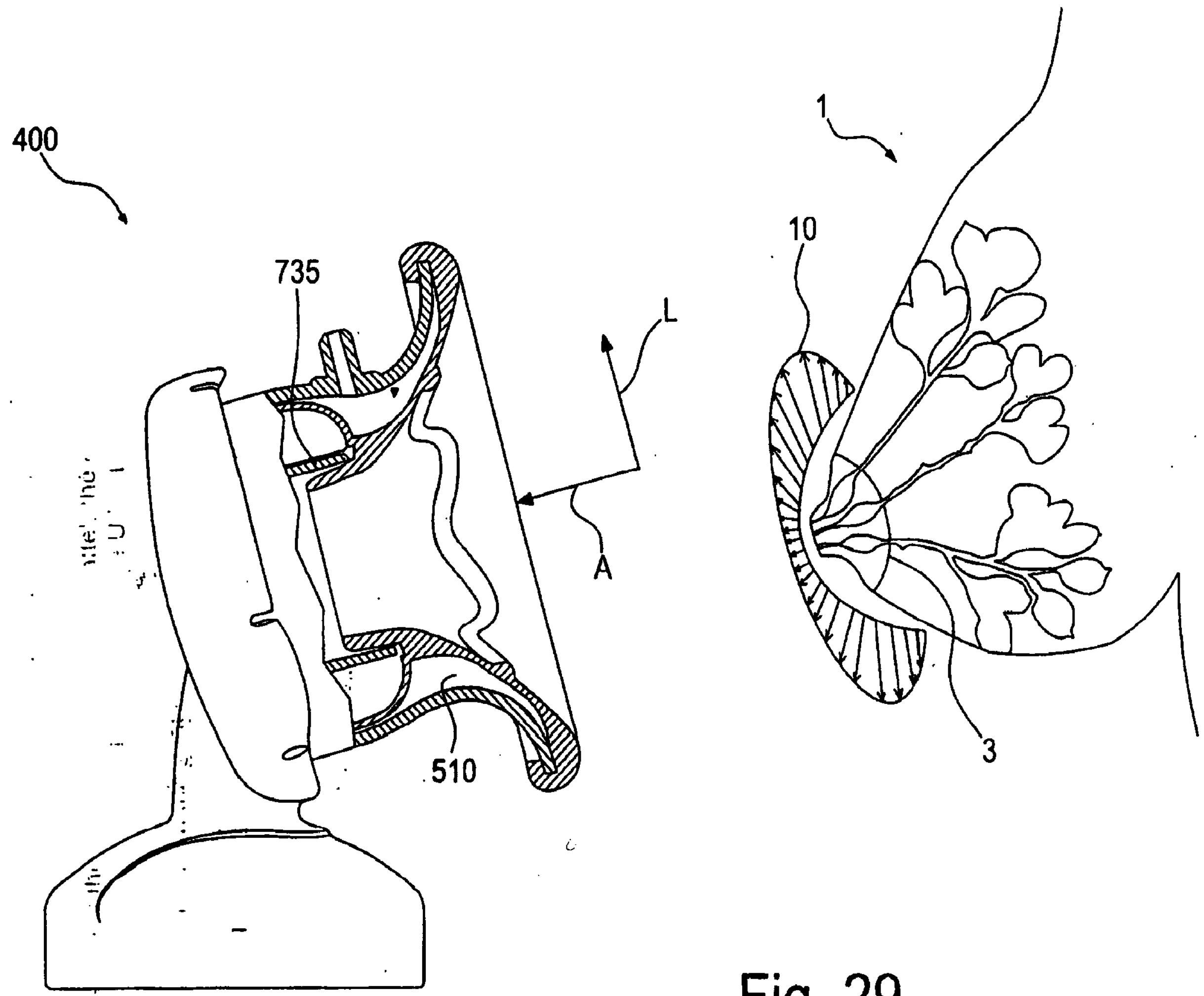


Fig. 29

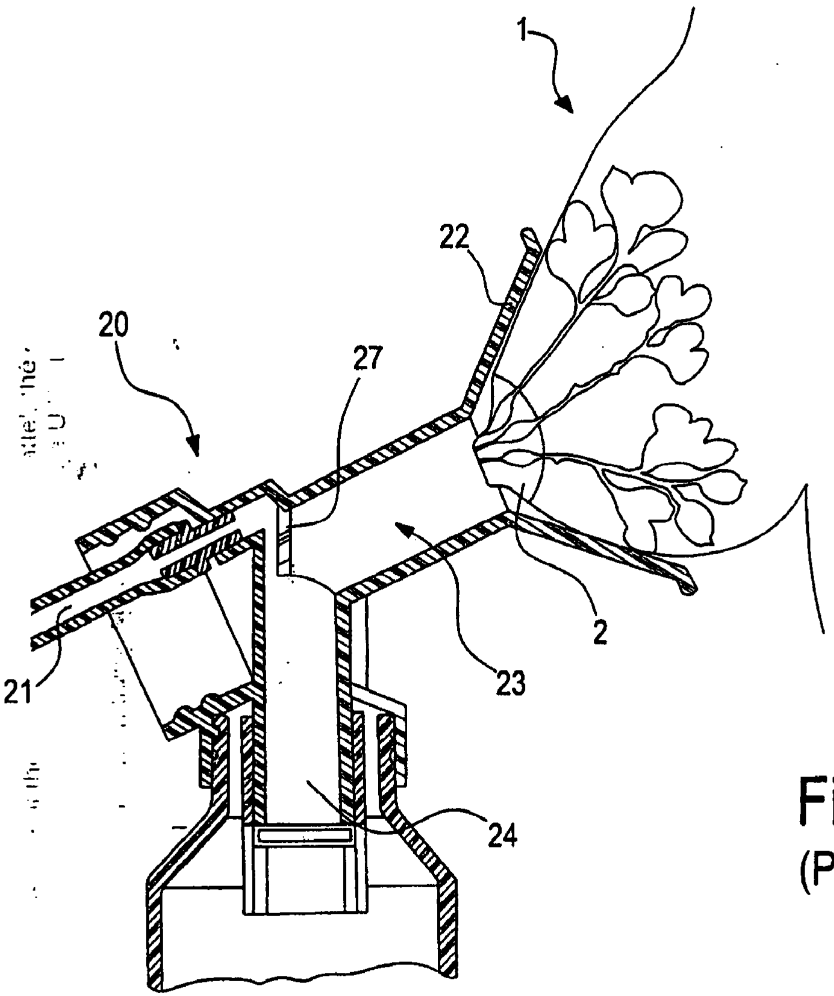


Fig. 30
(Prior Art)

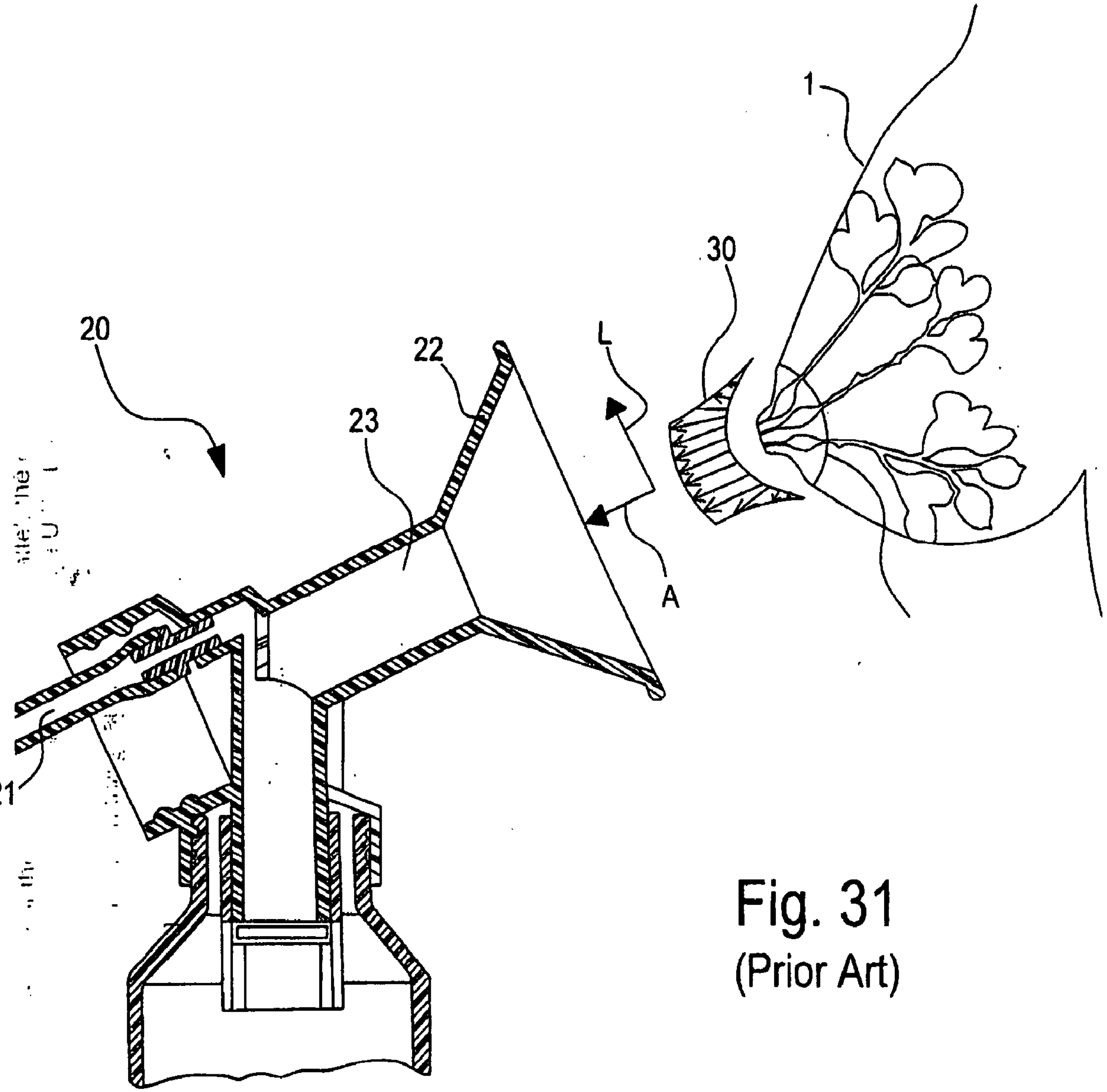


Fig. 31
(Prior Art)

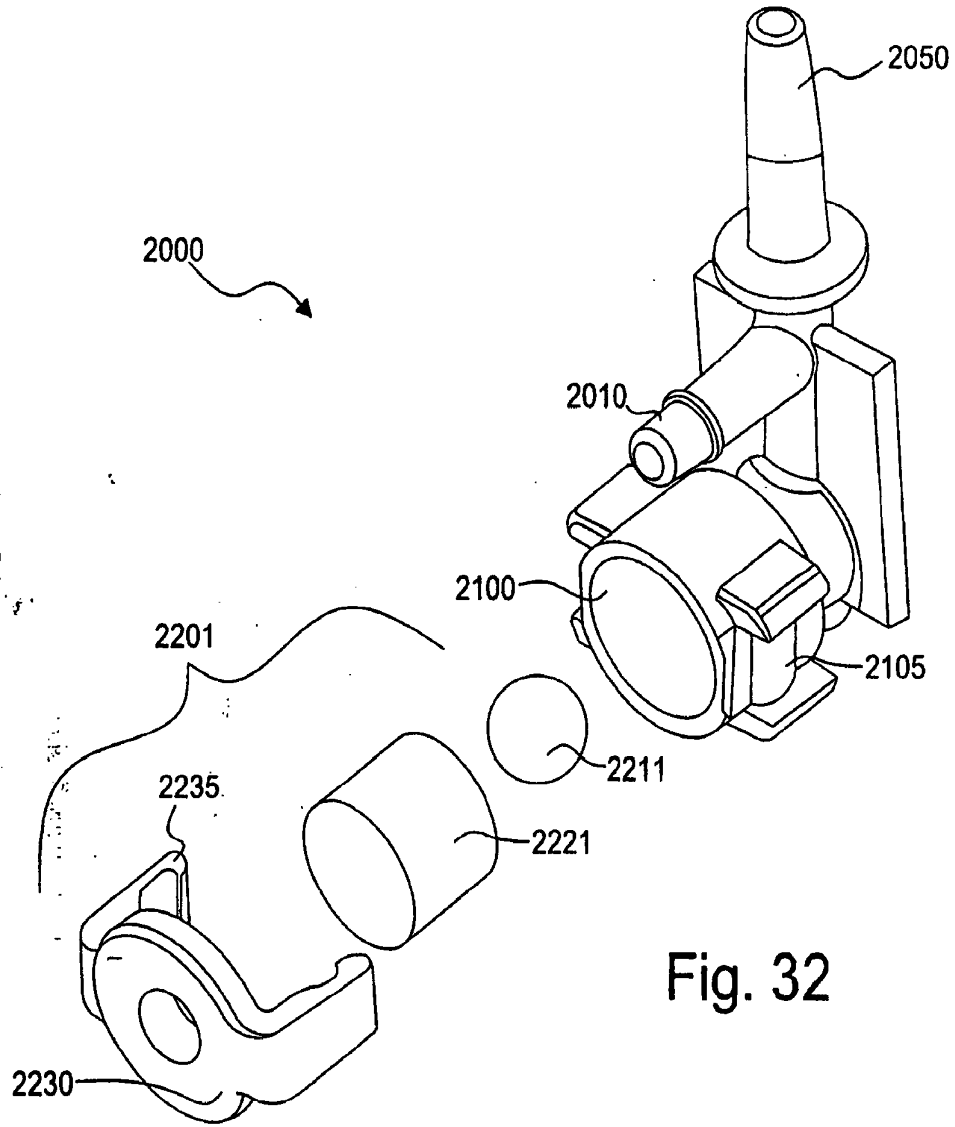


Fig. 32

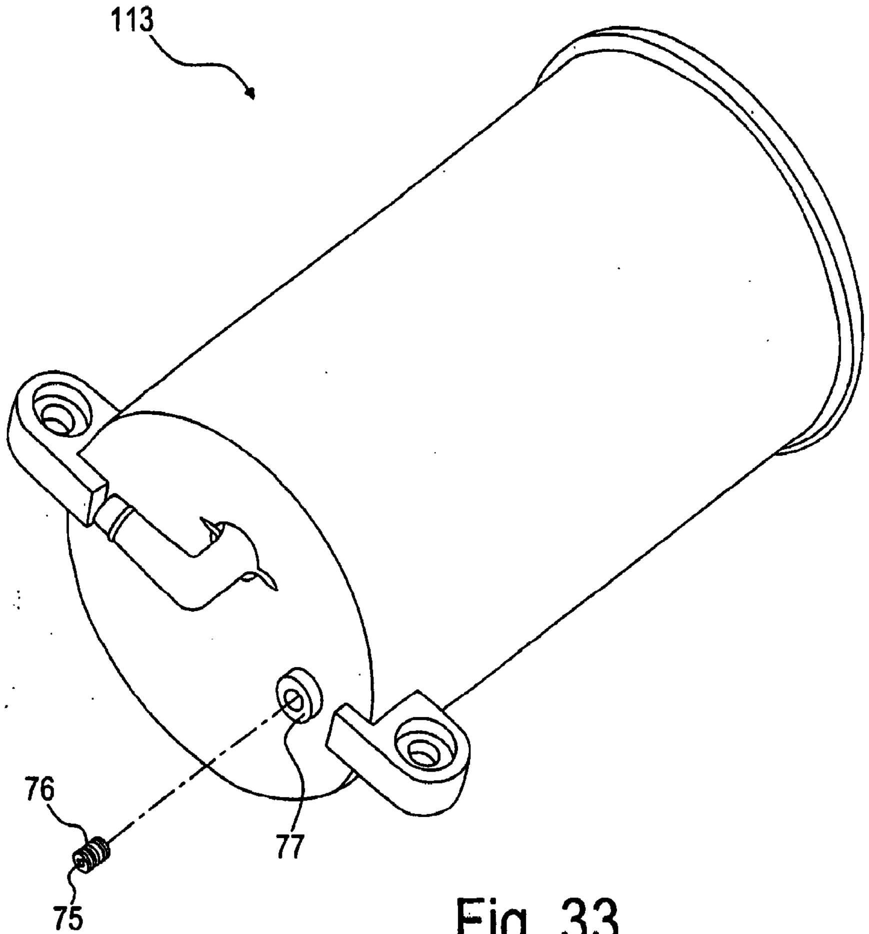


Fig. 33

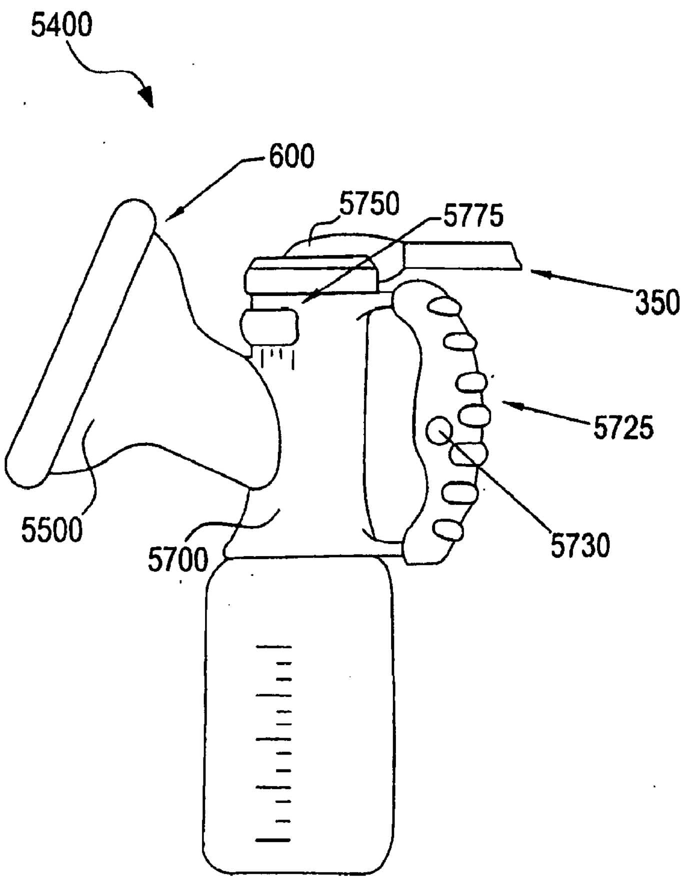

5400
600
5750
5775
350
5725
5500
5700
5730

Fig. 34

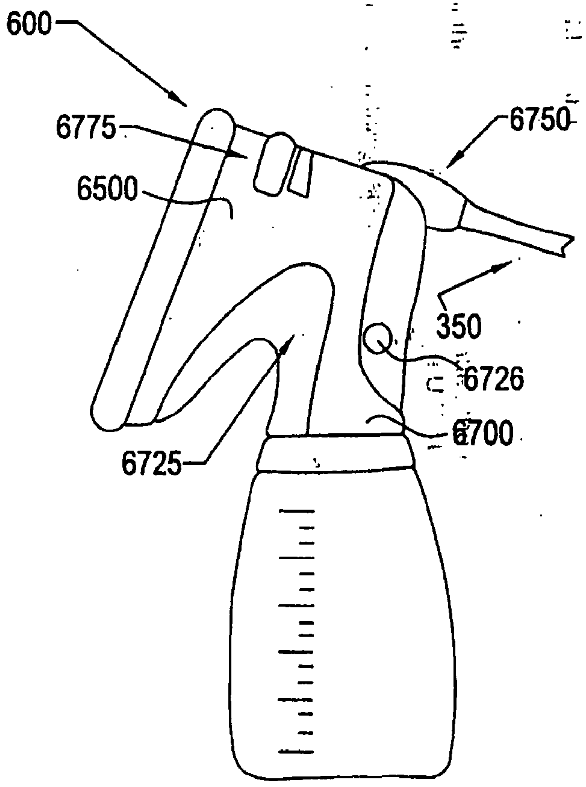

600
6775
6750
6500
350
6726
6700
6725

Fig. 35

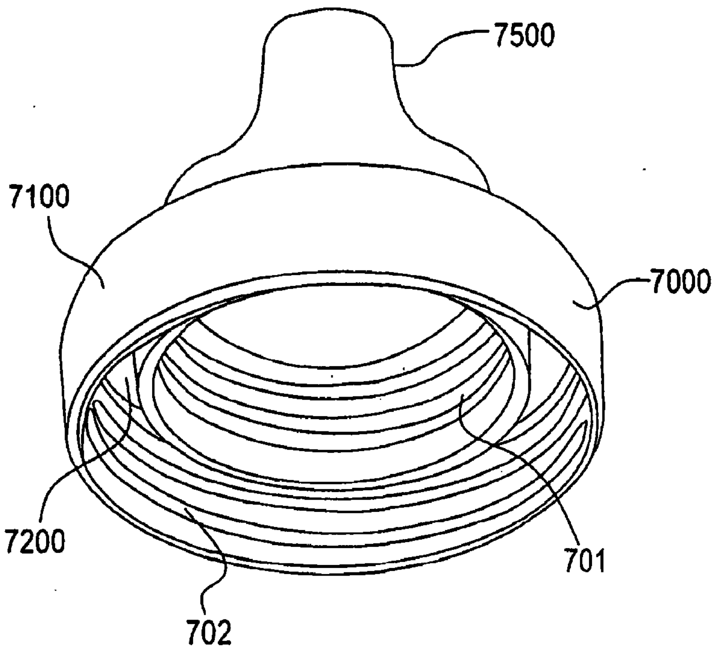


Fig. 36

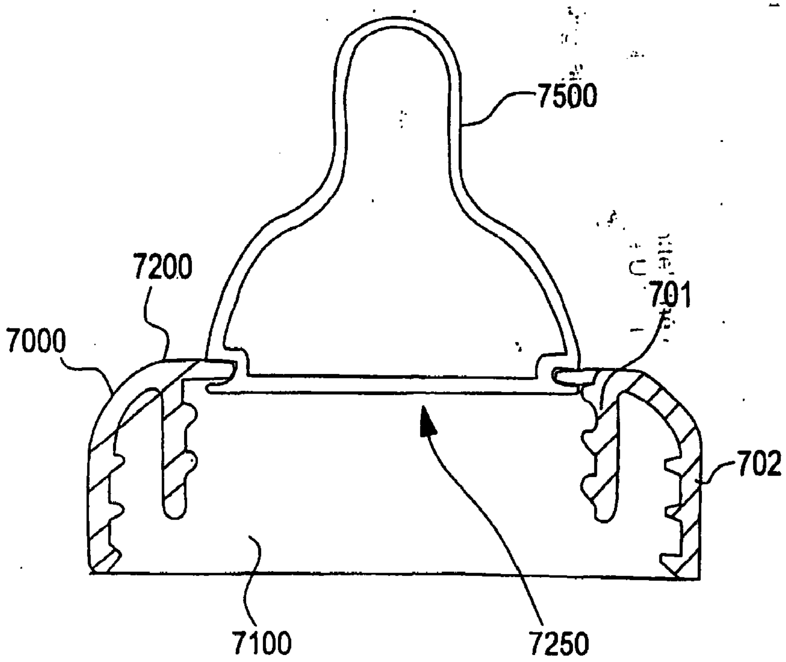


Fig. 37

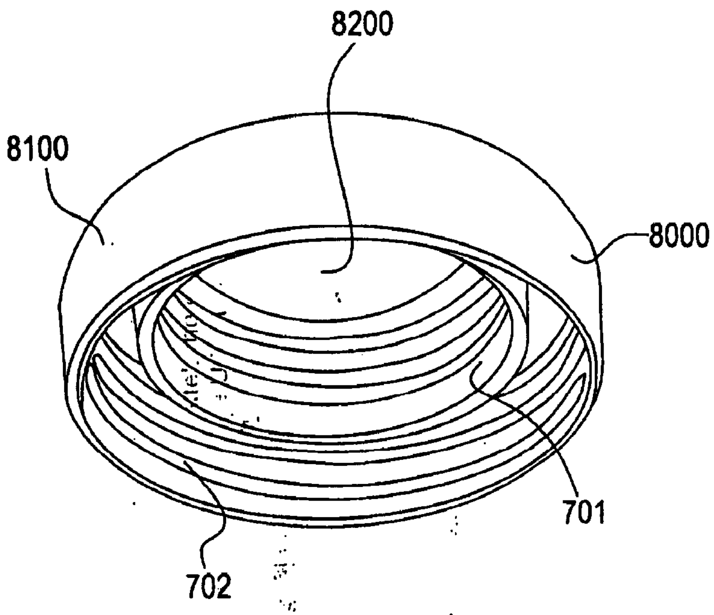


Fig. 38

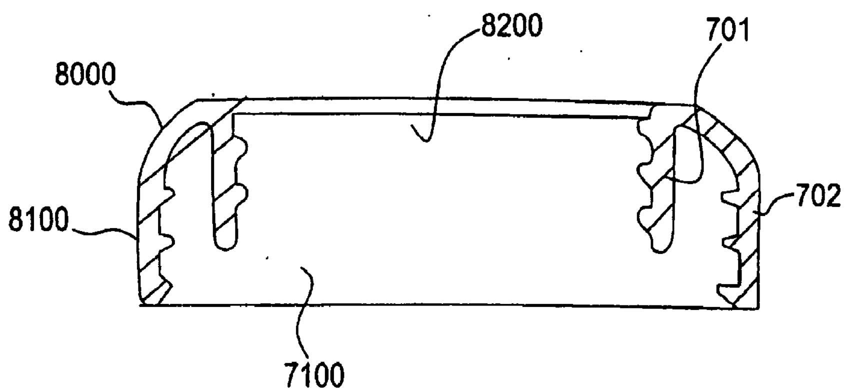


Fig. 39

BREAST PUMP

BACKGROUND OF THE INVENTION

The present invention relates to apparatus and methods for obtaining breast milk. More particularly, the present invention relates to a breast pump that can apply a variable pressure to a breast to express breast milk and to a method effecting the same.

Breast pump systems for obtaining breast milk, both manually and automatically, are known in the art. Conventional systems use a vacuum source to generate a negative pressure or vacuum that is transmitted through tubing to a breast hood or cup that is placed on the breast. This conventional device and method uses a negative pressure on the breast to express the breast milk.

Such systems suffer from the drawback of applying only a vacuum source as negative pressure to the breast to induce the expression of breast milk. Moreover, such conventional systems suffer from the drawback of applying the negative pressure or force axially to the nipple, resulting in elongation and distention of the nipple in an axial direction that is both uncomfortable and inefficient for the expression of breast milk.

SUMMARY OF THE INVENTION

It is an object of the present invention to substantially monitor and control the pressure source of a breast pump in real-time.

It is an object of the present invention to provide a breast pump system for expressing milk that can apply a positive pressure or a negative pressure to a breast to express the milk.

It is another object of the present invention to provide such a system that supplies the positive and negative pressure from a single source.

It is still another object of the present invention to provide such a system that facilitates control of the positive and negative pressure applied to the breast.

It is yet another object of the present invention to provide such a system that widens the nipple to express milk.

It is a further object of the present invention to provide such a system that reduces axial elongation or distention of the nipple.

It is another further object of the present invention to apply a negative force or negative pressure gradient to the nipple that has a greater lateral component than axial component.

It is yet a further object of the present invention to accommodate breasts of differing size and/or shape by providing a kit with interchangeable breast hoods of differing size and/or shape.

These and other objects and advantages are provided by a breast cup having a hood for receiving the breast and in fluid communication with a pressure source. The hood creates a negative force on the nipple during a negative pressure stroke. The negative force has a lateral component and an axial component. The lateral component is greater than the axial component.

The present invention includes a breast pump for expressing breast milk from a breast, the pump comprising a pressure source with a movable structure for generating

pressure during a pressure stroke. The movable structure has a variable pressure volume or variable cycle time. The pump also has a controller operably connected to the pressure source. The controller regulates the pressure volume based upon a distance traveled by the movable structure and regulates the variable cycle time based upon a speed of the movable structure. The controller provides substantially real-time monitoring of the distance traveled and the speed.

Preferably, the controller regulates the pressure cycle based on a non-sinusoidal wave signal of the pressure versus variable cycle time.

A method of expressing breast milk from a breast is described having the steps of applying a pressure to the breast; and performing substantially real-time monitoring and controlling of the pressure with a controller. Said pressure may be controlled in part based on a variable pressure volume of a movable structure or a variable cycle time of said movable structure. As before, the controller regulates the pressure volume based upon a distance traveled by the movable structure or regulates the variable cycle time based upon a speed of the movable structure and the controller provides substantially real-time monitoring of the distance traveled or the speed.

Preferably, the controller regulates the pressure cycle based on a non-sinusoidal wave signal of the pressure versus a cycle time.

There is disclosed a breast cup having a breast receiving member in fluid communication with a vacuum source. The breast receiving member applies a negative pressure to the nipple during a negative pressure stroke causing the nipple to widen along a lateral direction.

Described is a breast pump system having a pressure source and a breast cup for receiving the breast. The breast cup is in fluid communication with the pressure source.

The breast cup creates a negative force on the nipple during a negative pressure stroke. The negative force has a lateral component and an axial component. The lateral component is greater than the axial component.

A breast pump system is also disclosed having a vacuum source and a breast receiving member that is in fluid communication with the vacuum source. The breast receiving member applies a negative pressure to the nipple during a negative pressure stroke causing the nipple to widen along a lateral direction.

Additionally disclosed is a breast pump kit having a holder and a plurality of hoods for receiving the breast. Each of the plurality of hoods are selectively engageable to the holder and a pressure source for expressing the breast milk from the breast. At least one of the plurality of hoods has a different size or a different shape than another of the plurality of hoods.

There is described a breast pump system having a pump generating pressure and a plurality of hoods for receiving the breast. Each of the plurality of hoods are selectively fluidly connectable to the pump for expressing the breast milk from the breast. At least one of the plurality of hoods has a different size or a different shape than another of the plurality of hoods.

A breast pump system is disclosed having a pressure source with an evacuation volume for generating a pressure and an air hole. The system also has a breast cup for receiving the breast and in fluid communication with the pressure source for applying the pressure to the breast. The air hole has a diameter and is in fluid communication with the atmosphere and the evacuation volume. The diameter of the air hole is between about 0.15 mm to 0.75 mm.

A method describes expressing breast milk from a breast having the steps of applying a negative pressure to the breast from a pressure source during a vacuum stroke; applying a positive pressure to the breast from the pressure source during a massage stroke; and providing air from the atmosphere to the pressure source during the vacuum stroke.

There is also a method disclosing the expression of breast milk from a breast having the step of applying a negative pressure on at least a portion of the nipple causing the nipple to widen along a lateral direction.

A pump for providing pressure is described which has a housing, an actuator and an insert. The housing defines a volume and has a pressure exhaust. The actuator is operably connected to the housing for producing the pressure in the volume. The insert is connected to the housing. The insert has a hole disposed therethrough. The hole provides fluid communication between the volume and atmosphere.

A breast cup is disclosed for placing a breast in fluid communication with a first container and a second container that have openings with different diameters. The breast cup has a funnel for receiving the breast and a housing connected to the funnel. The funnel has a base. The base has a circumferential wall, a flange extending inwardly from the circumferential wall to define an opening, first threads, and second threads. The first threads have a first diameter and a first pitch. The first diameter and the first pitch allow for selective engagement with the first container. The second threads have a second diameter and a second pitch. The second diameter and the second pitch allow for selective engagement with the second container. The first threads and the second threads are concentrically disposed along the base.

There is also described a nipple ring for engaging a nipple with a first container and a second container that have openings with different diameters. The nipple ring has a

body having a circumferential wall, a flange extending inwardly from the circumferential wall to define an opening, first threads, and second threads. The first threads have a first diameter and a first pitch. The first diameter and the first pitch allow for selective engagement with the first container. The second threads have a second diameter and a second pitch. The second diameter and the second pitch allow for selective engagement with the second container. The first threads and the second threads are concentrically disposed along the body.

Also disclosed is a cap for engaging with a first container and a second container that have openings with different diameters. The cap has a body with a circumferential wall, a top wall connected to the circumferential wall, first threads, and second threads. The first threads have a first diameter and a first pitch. The first diameter and the first pitch allow for selective engagement with the first container. The second threads have a second diameter and a second pitch. The second diameter and the second pitch allow for selective engagement with the second container. The first threads and the second threads are concentrically disposed along the body.

The first pitch can be equal to the second pitch. The first threads can extend from the flange. The second threads can be disposed on the circumferential wall. The funnel can be selectively removable from the housing.

The housing can be a first material and the insert can be a second material. The housing can be plastic and the insert can be metal. The housing can be a cylinder and the actuator can be a piston. The cylinder can be an orifice and the insert can be disposed in the orifice. The insert can be press fit into the orifice. The insert can be a plurality of inserts, and each of the plurality of inserts can be selectively engageable with the cylinder.

The breast cup can also have a barrier member operably connected to the hood, wherein the barrier member reduces the axial component of the negative force during the

negative pressure stroke. The hood can have a housing, a flexible insert sealingly secured to the housing, and a displacement volume formed between the housing and the flexible insert, wherein the displacement volume is in fluid communication with the pressure source. The displacement volume can substantially surround the nipple when the breast is received in the hood. The flexible insert can have a bladder in fluid communication with the pressure source with the displacement volume being defined at least partially by the bladder. The bladder and the displacement volume can contract to form the negative force on the nipple during the negative pressure stroke.

The breast cup can also have a barrier member disposed substantially adjacent to the bladder, thereby preventing the breast from contacting the bladder. The flexible insert can define an inner volume for receiving the breast, and the barrier member can have a cylindrical shape and be disposed in the inner volume. The flexible insert can have a funnel shape with a massaging projection formed thereon. The massaging projection can have a star-like shape.

The negative pressure created at the breast cup can cause the nipple to widen along a lateral direction more than the nipple elongates along an axial direction. The negative pressure can have an average lateral component and an average axial component, wherein during the negative pressure stroke the average lateral component is greater than the average axial component. The barrier member can be operably connected to the breast receiving member, and can reduce elongation of the nipple along the axial direction during the negative pressure stroke. The breast receiving member can have a housing, a flexible insert sealingly secured to the housing, and a displacement volume formed between the housing and the flexible insert, wherein the displacement volume is in fluid communication with the vacuum source.

The vacuum or pressure source can be a piston movably disposed in a cylinder. The system can have a reversible motor operably connected to the piston. The system can

also have a rack having first teeth and a gear having second teeth. The rack can be connected to the piston and the gear can be operably connected to the reversible motor. The first teeth can engage with the second teeth to reciprocally move the piston in the cylinder. The cylinder can have a first diameter and an air hole. The air hole can have a second diameter and be in fluid communication with the atmosphere. The first diameter of the cylinder can be significantly larger than the second diameter of the air hole.

The system can have a controller operably connected to the reversible motor. The controller can determine a distance that the piston has traveled relative to the cylinder. The controller can reverse the motor based at least in part upon that distance. The system can also have a motor with variable speed. The controller can adjust the speed based upon a desired cycle time for applying the negative pressure to the breast. The controller can regulate the pressure cycle based on a non-sinusoidal wave signal of pressure versus variable cycle time.

Each of the plurality of hoods of the kit can have a housing, a flexible insert sealingly secured to the housing, and a displacement volume formed between the housing and the flexible insert and in fluid communication with the pressure source. The housing and/or the flexible insert of the at least one of the plurality of hoods can have a different size or a different shape than the housing and/or the flexible insert of the another of the plurality of hoods. The kit can also have a container, wherein the holder is selectively engageable with the container. The holder can have a plurality of engagement structures for selectively engaging a plurality of different sized containers. The flexible insert of the at least one of the plurality of hoods can have a first massaging projection, and the flexible insert of the another of the plurality of hoods can have a second massaging projection. The first and second massaging projections can have a different size or a different shape.

BRIEF DESCRIPTION OF THE DRAWINGS

Other and further objects, advantages and features of the present invention will be understood by reference to the following:

Fig. 1 is a front perspective view of a breast pump of the breast pump system of the present invention;

Fig. 2 is a front perspective view of the breast pump of Fig. 1 in an opened position;

Fig. 3 is an exploded perspective view of the breast pump of Fig. 1;

Fig. 4 is a top view of the breast pump of Fig. 1 without the cover;

Fig. 5 is an exploded perspective view of a piston and cylinder of the present invention;

Fig. 6 is an exploded side view of a portion of the piston and cylinder of Fig. 5;

Fig. 7 is a front perspective view of the piston of Fig. 5;

Fig. 8 is an exploded perspective view of an alternative embodiment of the piston;

Fig. 9 is an exploded perspective view of a pressure relief valve of the system of Fig. 1;

Fig. 10 is a cross-sectional plan view of the cylinder of Fig. 5;

Fig. 11 is a front perspective view of a breast cup;

Fig. 12 is a side cross-sectional view of the breast cup of Fig. 11;

Fig. 13 is a rear perspective view of a T-connector;

Fig. 14 is a flow chart depicting a method for pumping a breast according to the system of Figs. 1 and 11;

Fig. 15 is a top perspective view of a preferred embodiment of breast pump for the breast pump system of the present invention;

Fig. 16 is a top view of the breast pump of Fig. 15;

Fig. 17 is a top perspective view of the drive system of the breast pump of Fig. 15;

Fig. 18 is a side perspective view of the drive system of Fig. 17;

Fig. 19 is a top perspective view of a portion of the gear reduction system of the drive system of Fig. 15, partially assembled;

Fig. 20 is a top perspective view of an alternative embodiment of breast pump for the breast pump system of the present invention;

Fig. 21 is a top view of the breast pump of Fig. 20;

Fig. 22 is a top perspective view of the drive system of the breast pump of Fig. 20;

Fig. 23 is a side perspective view of the drive system of Fig. 20;

Fig. 24 is a top perspective view of the motor of the drive system of Fig. 20;

Fig. 25 is a top perspective view of a portion of the gear reduction system of the drive system of Fig. 20, partially assembled;

Fig. 26 is a top perspective view of the gear reduction system of the drive system of Fig. 20, partially assembled;

Fig. 27 is a partial cross-sectional side view of the breast cup of Fig. 11 with a breast;

Fig. 28 is a partial cross-sectional side view of the breast cup of Fig. 27 applied to the breast prior to the negative pressure stroke;

Fig. 29 is an exploded cross-sectional view of the breast cup and breast of Fig. 27 during the negative pressure stroke showing a representation of the negative pressure gradient or force on the breast;

Fig. 30 is a cross-sectional side view of a prior art breast cup applied to a breast prior to the negative pressure stroke;

Fig. 31 is an exploded cross-sectional view of the prior art breast cup and breast of Fig. 30 during the negative pressure stroke showing a representation of the negative pressure gradient or force on the breast;

Fig. 32 is an exploded perspective view of the pressure relief valve of Fig. 9 with another embodiment of a relief assembly;

Fig. 33 is a perspective view of the cylinder of Fig. 5 with another embodiment of the pressure differential hole;

Fig. 34 is an alternative embodiment of a breast cup;

Fig. 35 is another alternative embodiment of a breast cup;

Fig. 36 is a bottom perspective view of a nipple ring with a nipple;

Fig. 37 is a side cross-sectional view of the nipple ring and nipple of Fig. 36;

Fig. 38 is a bottom perspective view of a cap; and

Fig. 39 is a side cross-sectional view of the cap of Fig. 38.

DESCRIPTION OF THE INVENTION

Referring to the drawings and, in particular, Figs. 1 and 2, there is shown a breast pump of the present invention generally represented by reference numeral 100. Breast pump 100, along with breast cup 400 shown in Fig. 11, form the major components of the breast pump system of the present invention. Breast pump 100 has a top housing 102 and a bottom housing 103 that are adapted to form an assembled unit.

Referring to Figs. 1 through 3, top housing 102 has a substantially ellipsoidal shape with a flat front face 200 and a storage compartment 210 having a compartment door 104. Preferably, door 104 is hingedly connected to top housing 102 to form a selectively sealable storage compartment 210 for storing air tubing or conduit 350 that connects breast pump 100 to the other components of the system, which will be discussed later in greater detail.

Face 200 can receive a button pad 105 having an LED cover 106. Pad 105 is used by the consumer to control breast pump 100. Bottom housing 103 can securely house the various components of the breast pump, which include a rack gear 109, a pinion gear 110 that can engage the rack gear, a piston 112, a cylinder 113 that can receive the piston, and a motor 125 having a shaft 126 upon which the pinion gear is mounted. Due in part to this design, breast pump 100 provides pumping with low noise. Breast pump 100 can be made of any rigid material, such as, for example, plastic.

Referring to Figs. 3 through 7, breast pump 100 utilizes piston 112 and cylinder 113 to create both a positive pressure and a negative pressure for obtaining breast milk. Piston 112 is driven by rack gear 109, which is affixed thereto. Piston 112 has a substantially cylindrical-shape with a first head 3000 and a second head 3100. First and second heads 3000, 3100 preferably have annular channels 3020, 3120 formed therein, respectively. Channels 3020, 3120 are disposed along the outer circumference of first and second heads 3000, 3100, respectively. Preferably, channels 3020, 3120 are centrally located along the outer circumference of first head 3000 and second head 3100. Seated in channels 3020, 3120 are sealing members 3050, 3150, respectively. Preferably, sealing members 3050, 3150 are o-ring gaskets. Sealing members 3050, 3150 have a diameter or width that is larger than the depth or height of channel 3020 and channel 3120. Sealing members 3050, 3150 extend beyond the outer circumference of first head 3000 and second head 3100 forming a sealing engagement with an inner surface 1130 of cylinder 113 as piston 112 is driven back and forth in the cylinder.

The use of multiple sealing members, i.e., o-ring gasket 3050 and o-ring gasket 3150 on piston 112, provide a double sealing to increase the efficiency of creating the positive pressure and negative pressure. While this embodiment uses two sealing members to create two separate sealing surfaces, any number of sealing members can be used to create any number of sealing surfaces for sealing piston 112 with cylinder 113.

Additionally, while this embodiment uses piston 112 having o-ring sealing gaskets 3050, 3150, alternative sealing structures can be used between the piston and cylinder 113.

Rack gear 109 has teeth 1090 that engage with pinion gear 110 having teeth 1100. Pinion gear 110 is operatively connected to motor 125, preferably via shaft 126. When motor 125 is activated, shaft 126 and pinion gear 110 rotate. Teeth 1090 on rack 109 and teeth 1100 on pinion 110 mesh and translate the reciprocal rotational motion of motor 125 and shaft 126 into a reciprocal longitudinal motion along a single axis in both directions.

Preferably, rack gear 109 has a first end 1095 that engages with a recess 3200 formed in piston 112. Recess 3200 is preferably centrally located in piston 112. First end 1095 of rack gear 109 preferably has a snap fit or friction fit engagement with recess 3200 of piston 112. Preferably, there are detent structures 1096, 3296 formed on first end 1095 and recess 3200, respectively. This facilitates production of these components and also provides for any slight pivotal movement that may be required of piston 112 with respect to rack gear 109.

An alternative embodiment of a piston is shown in Fig. 8 and generally represented by reference numeral 8112. Piston 8112 has a substantially V-shape with a leading edge 8120 and a trailing edge 8121. Leading edge 8120 and trailing edge 8121 sealingly engage an inner surface 1130 of cylinder 113 as piston 8112 is driven back and forth in the cylinder. The use of multiple edges, i.e., leading edge 8120 and following edge 8121, on piston 8112 that sealingly engage inner surface 1130 of cylinder 113, provide a double sealing to increase the efficiency of creating the positive pressure and negative pressure.

Referring to Figs. 3 through 7, motor 125 is preferably variable speed. This allows a user to control and vary the cycle time of the pumping of the breast. Breast

pump 100 further has a motor cover 107 and a bearing 108 to reduce vibration and to secure motor 125 to bottom housing 103.

The positive and negative pressures can be varied by changing the displacement of air volume in cylinder 113. In this embodiment, this is done by use of a photoelectric or photo-sensor system. The photo-sensor system has two or more photo-sensors 121 and a position switch 124. The photo-sensors 121 count the number of openings 50 on rack gear 109, as the rack gear moves back and forth. Thus, a user can control the distance that rack gear 109 travels and correspondingly control the air volume displacement in cylinder 113. Alternative displacement or distance monitors can also be used, such as, for example a coded wheel for counting the slots on the wheel; counting of the belt teeth; rotary encoder which counts its own revolutions; or a hall effect sensor.

To ensure that piston 112 is properly moving to the front of cylinder 113, the photo-sensor system further includes position switch 124, preferably located at the front of the cylinder, which acts as a starter for the counter. Alternatively, the position switch can be an opening 50 having a different size or shape that is detectable by photo-sensor 121.

Rack gear 109 can also have a safety mechanism attached thereto. Photo-sensor 121 will be reading openings 50 as rack gear 109 moves backwards. If for some reason rack gear 109 misses its target and moves too far, the safety will trigger the position switch. When the position switch is triggered while rack gear 109 is moving backwards, the software can trigger the system to move forward again and return to the position position.

Breast pump 100 has a guide cover 111 positioned over rack gear 109. Guide cover 111 provides added stability to the breast pump by guiding and vibration dampening the reciprocal movement of rack gear 109. Guide cover 111 also provides

accuracy to the photo-sensor system by reducing the risk of misalignment of photo-sensors 121 and openings 50.

The photo-sensor system and motor 125 are preferably connected to a PC or circuit board 120. Thus, the distance piston 112 travels, which translates to the amount of positive and negative pressure, and the piston speed, which translates to the cycle time, are electronically controlled.

Referring to Figs. 15 through 19, a preferred embodiment of a drive system is shown and generally represented by reference numeral 1500. Drive system 1500 is usable with breast pump 100 of Figs. 1 through 7 to provide the linear reciprocal movement of piston 112 with cylinder 113.

Drive system 1500 is a belt drive system for a rack and pinion drive having gear reduction incorporated therein. Drive system 1500 has a first drive wheel or pulley 1510; a second gear, drive wheel or pulley 1520 secured to the first drive wheel 1510; a third gear, drive wheel or pulley 4530; and a pinion gear 1540 secured to the third gear.

First drive wheel 1510 is operably connected to motor drive shaft 126 by a first belt 1550. In the preferred embodiment, first belt 1550 is a non-toothed belt. More preferably, first belt 1550 has resiliency or flexibility. The use of flexible or resilient belt 1550 provides a secure connection between drive shaft 126 and first drive wheel 1510 and also reduces noise and vibration. Drive shaft 126 and first drive wheel 1510 have smooth outer surfaces upon which the first belt 1550 is secured.

First drive wheel 1510 is operably connected to second gear 1520 by a first co-axial shaft 1515. In the preferred embodiment, first shaft 1515 is rotatably mounted between opposing first bearings 1517. However, alternative rotatable mounting arrangements or securing structures could also be used. To reduce noise and vibration,

motor shaft 126 and first drive wheel 1510 are made of metal. First drive wheel 1510 and second gear 1520 have different diameters that partially provide for gear reduction between motor shaft 126 and pinion gear 1540.

Second gear 1520 is operably connected to third gear 1530 by a second belt 1570. Preferably, second belt 1570 has teeth 1575 that mesh with teeth 1580 formed along the circumference of second gear 1520 and third gear 1530. Second and third gears 1520, 1530 have different diameters that partially provide for gear reduction between motor shaft 126 and pinion gear 1540. Drive system 1500 can also have a tension pulley 1580 that provides tension to second belt 1570.

Third gear 1530 is operably connected to pinion gear 1540 by a second co-axial shaft 1535. In the preferred embodiment, second shaft 1535 is rotatably mounted between opposing second bearings 1537. However, alternative rotatable mounting arrangements or securing structures could also be used. Preferably, third gear 1530 is integrally molded with pinion gear 1540 along second shaft 1535.

Pinion gear 1540 has teeth 1545 that engage with teeth 1090 of rack gear 109. When motor 125 is activated, the rotational motion of shaft 126 is translated into a reciprocal longitudinal motion along a single axis of rack gear 109 in both directions. Drive system 1500, through use of first and second belts 1550, 1570 and first, second and third drive wheels or gears 1510, 1520, 1530, is able to provide a desired ratio of movement between motor shaft 126 and pinion gear 1540, i.e., gear reduction.

The use of a combination of the non-toothed belt 1550 and the toothed belt 1570 reduces noise and vibration, while maintaining a secure, sturdy drive system 1500 that is able to provide the necessary back and forth linear motion at the desired speeds and pressure for breast pump 100.

Referring to Figs. 20 through 26, an alternative embodiment of a drive system is shown and generally represented by reference numeral 4500. Drive system 4500 is also usable with breast pump 100 of Figs. 1 through 7 to provide the linear reciprocal movement of piston 112 with cylinder 113.

Drive system 4500 is a belt drive system having gear reduction incorporated therein. Drive system 4500 has a first gear, drive wheel or pulley 4510; a second gear, drive wheel or pulley 4520 secured to the first gear; a third gear, drive wheel or pulley 4530; and a pinion gear 4540 secured to the third gear.

First gear 4510 is operably connected to motor drive shaft 126 by a first belt 4550. In the preferred embodiment, first belt 4550 is a plurality of belts, and more preferably, three belts. First belts 4550 are preferably non-toothed belts. More preferably, first belts 4550 are o-rings having resiliency or flexibility. The use of flexible or resilient belts 4550, such as, for example, o-rings, provides a secure connection between drive shaft 126 and first gear 4510, and also reduces noise and vibration. Drive shaft 126 and first gear 4510 have annular channels 4555, 4560, formed therein, respectively. Annular channels 4555, 4560 are guides that assist in holding first belts 4550 in place and facilitate assembly of drive system 4500.

First gear 4510 is operably connected to second gear 4520 by a first co-axial shaft 4515. In this alternative embodiment, first shaft 4515 is rotatably mounted between opposing first bearings 4517. However, alternative rotatable mounting arrangements or securing structures could also be used. To reduce noise and vibration, motor shaft 126 and first gear 4510 are made of metal. First and second gears 4510, 4520 have different diameters that partially provide for gear reduction between motor shaft 126 and pinion gear 4540.

Second gear 4520 is operably connected to third gear 4530 by a second belt 4570. Preferably, second belt 4570 has teeth 4575 that mesh with teeth 4580 formed along the circumference of second gear 4520 and third gear 4530. Second and third gears 4520, 4530 have different diameters that partially provide for gear reduction between motor shaft 126 and pinion gear 4540. Drive system 4500 can also have a tension pulley 4580 that provides tension to second belt 4570.

Third gear 4530 is operably connected to pinion gear 4540 by a second co-axial shaft 4535. In this alternative embodiment, second shaft 4535 is rotatably mounted between opposing second bearings 4537. However, alternative rotatable mounting arrangements or securing structures could also be used. Preferably, third gear 4530 is integrally molded with pinion gear 4540 along second shaft 4535.

Pinion gear 4540 has teeth 4545 that engage with teeth 1090 of rack gear 109. When motor 125 is activated, the rotational motion of shaft 126 is translated into a reciprocal longitudinal motion along a single axis of rack gear 109 in both directions. Drive system 4500, through use of first and second belts 4550, 4570 and first, second and third gears 4510, 4520, 4530, is able to provide a desired ratio of movement between motor shaft 126 and pinion gear 4540, i.e., gear reduction.

The use of a combination of the non-toothed o-ring belts 4550 and the toothed belt 4570 reduces noise and vibration, while maintaining a secure, sturdy drive system 4500 that is able to provide the necessary back and forth linear motion at the desired speeds and pressure for breast pump 100.

The embodiments of the drive systems 1500 and 4500 described above utilize belts for gear reduction. However, alternative embodiments can use a gear-box that reduces the gearing to the desired ratio that is transferred to the rack and pinion gearing that drives breast pump 100.

Referring back to Figs. 3 through 9, cylinder 113 has a supply tube 116 that is secured to a supply connector 115 for supplying the positive and negative pressure to breast cup 400. Preferably, supply connector has an outlet 215 disposed in storage compartment 210. Air tubing 350 can be secured to outlet 215 and also secured to breast cup 400. Storage compartment 210 can be opened or closed during the pumping operation. Cylinder 113 is in fluid communication with a pressure relief valve 2000 (shown in Fig. 9) that is preferably set at about 1.5 in. Hg.

Pressure relief valve 2000 has an intake 2010 and an exhaust 2050. Intake 2010 is in fluid communication with cylinder 113 and exhaust 2050 is in fluid communication with breast cup 400, by tubing 350. Pressure relief valve 2000 has a relief exhaust 2100 that is in fluid communication with intake 2010 and exhaust 2050. Relief exhaust 2100 is substantially tubular and is secured to a relief assembly 2200.

Relief assembly 2200 has a flexible insert 2210, a biasing member 2220 and a retaining member 2230. Flexible insert 2210 sealing engages with the inner surface of relief exhaust 2100 to prevent air from exiting through the relief exhaust. Insert 2210 has a securing member 2215 that mates with biasing member 2200. In this embodiment, securing member 2215 is a cross-shaped structure that is received in the inner volume of biasing member 2200. Preferably, biasing member 2220 is a spring. More preferably, biasing member 2220 is a coil spring. Retaining member 2230 is a cap-like structure having opposing retaining arms 2235 that engage with a corresponding pair of engaging protrusions 2105 positioned on the outer surface of relief exhaust 2100. Insert 2210 and spring 2220 are held in the inner volume of relief exhaust 2100 by cap 2230.

Spring 2220 has a biasing strength or resistance that is equal to the relief pressure of relief pressure valve 2000. When a positive pressure exceeds the relief pressure, which in this embodiment is preferably set at about 1.5 in. Hg, the force created on the inner

surface of insert 2210 overcomes the biasing force of spring 2220 and the insert moves toward cap 2230 and outside of the inner volume of relief exhaust 2100. Air exits pressure relief valve 2000 through relief exhaust 2100 until the positive pressure in the pressure relief valve decreases below the biasing strength of spring 2220, at which time insert 2210 moves back in the inner volume of the relief exhaust, sealingly engaging the inner surfaces of the relief exhaust.

Referring also to Fig. 32, pressure relief valve 2000 is shown with a preferred relief assembly 2201 that includes an insert 2211 and a biasing member 2221. Relief assembly 2201 functions similarly to the insert 2210 and the spring 2220 of relief assembly 2200, as described above. Insert 2211 is a ball and biasing member 2221 is foam having a cylindrical shape. Relief assembly 2201 is advantageous because the ball 2211 is more easily assembled in relief exhaust 2100. Additionally, the foam cylinder 2221 is more consistent because it easily mates with the ball 2211 and provides a consistent spring actuation force. Additionally, alternative pressure relief valves can be used which are adjustable so that the "massage strength", i.e., the amount of positive pressure on the user's breast, can be controlled.

Circuit board 120, shown in Fig. 3, allows a user to program several levels of speed and several levels of suction. In this embodiment, the speed (cycle time) ranges from about 45 cycles/minute (cpm) to about 75 cpm. The embodiment provides for pre-set programming of a number of speed levels within the speed range. Preferably, the number of levels can be from about two to about eight levels. More preferably, the user can program five levels of speeds within the speed range. The embodiment also envisions programming of the speed levels by the user.

The suction range for use with a single breast cup 400 and the preferred drive system 1500 shown in Figs. 15 through 21, is from about 3 in. Hg to about 10 in. Hg, and from about 3 in. Hg to about 8 in. Hg for two breast cups. The suction range for use with

a single breast cup 400 and the gear box system shown in Figs. 3 and 4 is from about 3 in. Hg to about 9 in. Hg, and from about 3 in. Hg to about 8 in. Hg for two breast cups. The embodiment provides for pre-set programming of a number of suction levels within the suction range. Preferably, the number of levels can be from about two to about eight levels. More preferably, the user can program five levels of suction within the suction range. The present invention also envisions programming of the suction levels by the user.

Computer software can also be used to control the amount of positive and negative pressure. This allows the amounts of positive and negative pressure to be personalized for the user and also varied over the duration of the pumping process to maximize efficiency.

Breast pump 100 is preferably controlled by a software-driven circuit board 120, along with a gear motor 125, a rack and pinion set 109, 110, and a piston system 112, 113. The software and system are designed to provide maximum flexibility and to facilitate changing of the pressure curve or "wave." This is feasible because the software controls the speed of motor 120 and the distance that piston 112 will travel in cylinder 113. The distance piston 112 travels relates to the pressure levels. By controlling speed and pressure levels with software, the pressure curve or "wave" can be controlled.

Once a determination is made that there is a specific "wave" or pressure curve that is similar to the sucking of an infant or most comfortable to the mother, then the desired wave can be obtained by changing the timing (motor speed and piston distance). Through use of software, a user has the ability to apply memory to a particular pressure curve and the variation of that pressure curve over time so as to maximize the comfort for the user.

In this embodiment, a sine wave is used for the control of breast pump 100. This is based on the assumption that the most comfortable pressure curve would be one that

increases and decreases in pressure gradually, similar to a sine wave, without sharp pressure peaks and valleys providing a pinching feeling on the user. The back and forth motion of piston 112 approximates the desired sine wave. However, to avoid sharp pressure peaks, the timing of piston 112 is slowed down at these peaks, and the pressure is held constant for a duration of time at the maximum and minimum suction points on the wave. This results in a pressure curve having a steady sine wave that is more comfortable to the user.

Alternative waves can also be used for the pressure curve, if such a wave is determined to be desirable by the mother. For example, if a mother prefers a "saw tooth" pressure curve with sharp peaks, the timing of piston 112 can be changed to simply cycle back and forth, minimizing the pause when piston 112 changes direction. Also, for example, if a mother prefers a "square curve", the timing of piston 112 can be changed to hold the piston position when the piston is ready to change direction, and then quickly ramp down and hold its position again before it ramps back up. This will create a "square curve" wave.

Use of software control provides for numerous choices of waves or pressure curves. This further allows the flexibility to change or offer greater choice with one breast pump 100. In contrast, contemporary pumps have the drawback of not allowing the flexibility of changing pressure curve waves. Breast Pump 100 allows for inter-cycle control of the pressure and speed. In the preferred embodiment, this is done through use of a reversible, variable speed motor 125 operably connected to a linear system incorporating piston 112 and cylinder 113. Thus, contemporary devices could seemingly use a particular sinusoidal pressure curve repeatedly, while the breast pump 100 has the ability to use any type of wave and to change the wave during the cycle.

The control system and software provide for a closed-loop control system or inter-cycle real-time adjustment. Thus, real-time monitoring of the control variables occurs,

such as piston distance traveled and speed. As the motor and other components age and wear, the closed-loop control system accounts for such detrimental changes to provide accurate cycle time and pressure sought by the user. The real-time monitoring and control provides effectively equal speed levels for both single and double cup pumping even with the changes in torque.

Cylinder 113 has a pressure differential hole 75. Preferably, pressure differential hole 75 is located along bottom face 80 of cylinder 113. Pressure differential hole 75 is substantially smaller than exhaust hole 1013 and supply tube 116 through which the air flows for generating the positive and negative pressure. Pressure differential hole 75 provides a variance in the amount of positive pressure as compared to the amount of negative pressure. Pressure differential hole 75 is effective for the higher ranges of vacuum to provide the "lost" air at the end of the vacuum stroke. On the positive pressure stroke, a small amount of air will be released through pressure differential hole 75 but the air will be reintroduced during the negative pressure stroke when the level of pressure is higher.

Referring to Fig. 33, cylinder 113 is shown with a preferred embodiment of a pressure differential insert 76. Pressure differential hole 75 is disposed through pressure differential insert 76. Insert 76 is then connected to cylinder 113 through a cylinder hole 77 disposed through the wall of the cylinder. Insert 76 is preferably press fit into cylinder hole 77. However, alternative connection methods can also be used, such as, for example, threads or adhesive. Pressure differential insert 76 is a machined metal piece that allows for the machining of pressure differential hole 75 with a precise diameter within very small tolerances.

The use of insert 76 is advantageous over disposing pressure differential hole 75 directly through the wall of cylinder 113 because of the significant lack of precision in either molding the hole or drilling the hole through a plastic part. Additionally, pressure

differential insert 76 can be selectively inserted through cylinder hole 77 so that a plurality of inserts having a plurality of differently sized pressure differential holes 75 can be used. By providing for different diameters for pressure differential hole 75, the suction levels produced by the pump can be altered.

Pressure differential hole 75 allows for reclaiming of the air during the negative pressure stroke that is lost over time during use of breast pump 100 so that the positive pressure can be accurately maintained over time. During testing of breast pump 100, unexpected and significant results occurred from the use of differently sized diameters of pressure differential hole 75. It was discovered that a pressure differential hole 75 having a diameter of between about 0.15 mm to about 0.75 mm maintained an accurate positive pressure over time while providing the desired negative pressure. The volume of cylinder 113 was 126 cm^3. Preferably, pressure differential hole 75 has a diameter of between about 0.25 mm to about 0.5 mm, and most preferably the diameter is about 0.3 mm.

Referring to Fig. 10, cylinder 113 is formed as a zero- draft cylinder. The outer diameter of piston 112 creates a seal with the inner diameter d of cylinder 113 to move the volume of air inside the cylinder, creating vacuum and pressure on the breast. Breast pump 100 requires a cylinder 113 that has a consistent inner diameter d through the entire length of the cylinder to create an appropriate seal while minimizing interference or resistance to piston 112. Typical injection molded parts require a draft angle that would create a non-uniform inner diameter d of cylinder 113.

Cylinder 113 is preferably molded as a zero-draft cylinder that provides a uniform inner diameter d and more preferably, molded in a single piece. As shown in Fig. 10, cylinder 113 is a one piece, plastic injection molded part. A two-part cylinder or a machined-cylinder have drawbacks which the single piece, zero draft cylinder 113 overcomes. The two-part cylinder requires an extruded tube attached to an end cap, with the two parts joined using a weld or using an adhesive. The machined part is typically a

metal tube. One of the advantages to the zero-draft, one-piece cylinder 113 is that it is injection moldable.

Referring to Figs. 3 through 10, button pad 105 is the user interface or control mechanism for breast pump 100. Button pad 105 has a pair of positive and negative keys for increasing or decreasing the level of suction and speed. Pad 105 further includes an on/off switch.

Due to the reciprocal back and forth motion of piston 112 in cylinder 113, breast pump 100 supplies both a positive pressure and a negative pressure to a woman's breast through a single hose or tubing 350. While this embodiment uses a piston/cylinder mechanism to create positive and negative pressure, alternative expandable volumes or pressure sources can also be used. Such alternative embodiments include a bellows mechanism or a diaphragm that would require fewer parts.

Referring to Figs. 11 and 12, breast Cup, hood, or breast receiving member 400 is shown. Breast cup 400 has a housing 500 having an air orifice 560, a flexible insert 600, and a holder 700. Housing 500 is a rigid structure and flexible insert 600 is a flexible structure. Housing 500 is adapted for sealing engagement with insert 600 to form a displacement volume 510 between the housing and the insert. The funnel-like shape of insert 600 provides for an inner volume 655 for receiving of the breast. Air orifice 560 is in fluid communication with displacement volume 510.

Breast pump 100 is placed in fluid communication with breast cup 400 via air tubing 350 that is connected to air orifice 560 and in fluid communication with cylinder 113. Breast pump supplies both a positive and negative pressure to breast cup 400. The positive and negative pressure created by breast pump 100 causes air to flow through air orifice 560 into and out of displacement volume 510. The positive and negative pressure supplied to breast cup 400 causes flexible insert 600 and, in particular, displacement

volume 510 to expand and contract to apply reciprocating positive and negative forces on the user's breast.

Due to the negative pressure being created by evacuation of displacement volume 510 and the substantial collapsing of insert 600 upon housing 500, breast cup 400 has a maximum suction level inherently incorporated therein. Unlike contemporary devices that provide vacuum directly to the nipple from the vacuum source and are thus vulnerable to over-sucking, breast cup 400 can only provide a maximum negative pressure based upon the displacement volume 510. Once all of the air is evacuated from displacement volume 510, breast cup 400 preferably no longer increases the negative pressure or force applied to the breast. Breast pump 100 and breast cup 400 are able to apply both a positive and a negative pressure to a user's breast through a single air tubing 350, which is connected to air orifice 560.

The volume disposed in displacement volume 510 is preferably between 22 to 52 cubic centimeters, and more preferably between 32 to 42 cubic centimeters. The expandable and contractible displacement volume 510 provides an upper limit to the amount of negative pressure that can be applied to a user's breast, which can further serve as a safety feature in use of breast pump 100. Additionally, the sealing engagement of insert 600 and housing 500 provides a barrier between the user's breast and breast pump 100 to prevent any breast milk from entering air tubing 350 or the breast pump. Insert 600 can also include a massaging member 634. Massaging member 634 has a star-like shape, which provides additional massaging action to the breast. Alternative shapes can also be used for massaging member 634.

Referring to Figs. 27 through 29, breast cup 400 is shown in partial cross-section with a breast 1. The breast 1 has a nipple 2 with an areola 3, and milk lakes or ducts 4, which are supplied by milk glands 5. Breast cup 400 has bladders 685 on insert 600 and tubular member 735 on holder 700. Bladders 685 partially define displacement volume

510. When air is evacuated from the bladders 685 and the displacement volume 510 such that insert 600 is pulled toward and against housing 500, then the negative pressure, vacuum or negative force is applied to breast 1.

Tubular member 735 is disposed substantially adjacent to bladders 685 and extends partially through insert 600. Tubular member 735 is a rigid barrier between the breast 1 and bladders 685 to prevent the breast from making contact with and impinging the bladders, which would reduce the amount of their inflation and deflation, and thus reduce the reciprocating pressure applied to the breast.

Positioning of the breast cup 400 on the breast 1, results in the nipple 2, areola 3 and milk ducts 4 being substantially surrounded by displacement volume 510. Nipple 2 being substantially surrounded by the displacement volume and the use of tubular member 735 to create a rigid barrier in front of areola 3 and adjacent to bladders 685, results in a negative pressure gradient, vacuum or negative force 10 being applied to nipple 2 upon evacuation of the air in displacement volume 510 during the negative pressure stroke or cycle, as represented in Fig. 29. The negative pressure gradient or force 10 has a lateral component or direction L that is greater than an axial component or direction A. The negative pressure gradient or force 10 and the larger lateral component L causes the nipple 2 to be pulled or sucked laterally more than axially, which has been shown to be significantly more efficient at causing expression of breast milk from the milk ducts 4. The negative pressure gradient or force 10 has also been shown to be more comfortable for the user and more like the sucking of a baby during breast-feeding, due in part to the widening of the nipple 2 as opposed to axially elongating or distending the nipple along axial direction A.

Displacement volume 510 extends almost to the leading edge of housing 500 where the housing is secured to insert 600, which assists in creating the negative pressure gradient or force 10 during the negative pressure stroke or cycle that causes lateral

sucking and lateral movement of the nipple 2 along the lateral component L. As shown in Fig. 29, the negative pressure gradient, vacuum or force 10 extends beyond the outer circumference of the areola 3 and is substantially laterally applied thereto during the negative pressure stroke or cycle, which further assists in creating a force on the nipple 2 with a greater lateral component L than axial component A and thus a widening of the nipple.

The positioning of tubular member 735 helps reduce the negative pressure gradient or force 10 axially from or in front of, the nipple 2 during the negative pressure stroke or cycle, which reduces discomfort associated with axial distention of the nipple. Tubular member 735 has an opening (not shown) formed along the tubular member wall. For softer breasts 1, which are pulled into the tubular member 735 during the negative pressure stroke, the opening allows application of the negative pressure or vacuum to the distal end of the nipple 2.

Referring to Figs. 30 through 31, a contemporary breast cup 20 is shown which is connected to a vacuum source through a vacuum line 21. The contemporary breast cup 20 has a hood 22 that can engage the breast 1 and a cylindrical extension 23 attached to the hood. The cylindrical extension 23 is in fluid communication with the vacuum line 21 and a collection member 24. The vacuum or negative pressure is supplied from the vacuum line through the cylindrical extension 23 and to the areola 2. A separation wall 27 seemingly prevents the breast milk from entering the vacuum line 21. The evacuation of the air in cylindrical extension 23 creates a negative pressure gradient or force 30 during the negative pressure stroke, as represented in Fig. 31.

The negative pressure gradient or force 30 has a greater axial component A than lateral component L during the negative pressure stroke, causing the nipple 2 to be pulled or sucked axially more than laterally, which has been shown to be significantly less efficient at causing expression of breast milk from the milk ducts. The negative pressure

gradient or force 30 having a greater axial component A than lateral component L during the negative pressure stroke, has also been shown to be uncomfortable for the user. The vacuum or negative pressure is supplied axially from or in front of, nipple 2 during the negative pressure stroke or cycle, which causes discomfort associated with axial elongation and distention of the nipple.

While breast cup 400 uses a flexible insert 600 partially defining a displacement volume 510 that applies the negative pressure gradient, vacuum or force 10 to the nipple 2 during the negative pressure stroke or cycle, the embodiment contemplates the use of other designs and arrangements that create the negative pressure gradient, vacuum or force 10. Alternative designs for breast cup 400 that cause greater widening of the nipple along the lateral component L as opposed to elongation or distention of the nipple along the axial component A during the negative pressure stroke or cycle are contemplated. Also, alternative designs for breast cup 400 that apply a negative force to nipple 2 during the negative pressure stroke having an average lateral component L that is greater than the average axial component A are contemplated. Further, alternative designs for breast cup 400 that apply a negative pressure gradient or vacuum to nipple 2 during the negative pressure stroke having an average lateral component L that is greater than the average axial component A are contemplated.

While the preferred embodiment describes the use of a motorized pump 100 that supplies the pressure to breast cup 400, the use of manual pumps for use with breast cup 400 is contemplated, including pumping mechanisms that are affixed to breast cup 400. Additionally, other barrier structures, designs or methods are contemplated which reduce the negative pressure, vacuum or negative force applied to the distal end or front of nipple 2, and/or reduce the axial component A of the negative pressure, vacuum or negative force applied to the nipple 2, as compared to the lateral component L.

It is contemplated that a valve or other known release mechanism (not shown) in fluid communication with displacement volume 510 could be used so that a user could alternatively selectively control the amount of positive or negative pressure at the breast cup 400 rather than only at the breast pump 100. The valve or release mechanism on the breast cup 400 could also be a quick release mechanism as a safety feature in the event of discomfort to the user. The valve or release mechanism could also be used to selectively allow only positive or negative pressure to be generated at the breast cup 400.

The modularity of breast cup 400 through use of three separate pieces that can be easily assembled, i.e., housing 500, insert 600 and holder 700, allows a kit to accommodate breasts of varying sizes and shapes. The kit can include a plurality of differently sized housings 500 and inserts 600, as well as differently shaped housings 500 and inserts 600, to accommodate different sized breasts and different shaped breasts. The plurality of different housings 500 and inserts 600 can all be assembled to holder 700 and can be connected to breast pump 100. An example of the variation in sizes of housings 500 and inserts 600 includes the inner and outer diameters throughout the housings and inserts, as well as the length of the housings and inserts. An example of the variation in shapes of housings 500 and inserts 600 includes varying the taper angle, as well as changing the circular shape of the leading edge of the housing and insert. Additionally, the modularity and interchangeability allows for the use of different shaped or sized massaging members or projections 634 on different inserts 600.

A kit containing a plurality of differently sized or shaped inserts 600 that can all be assembled to housing 500 and holder 700, to form a plurality of different breast cups 400 for use with breast pump 100 is also contemplated. The plurality of differently sized inserts 600 can be used to accommodate different sized breasts and also to change the displacement volume 510. The plurality of differently shaped inserts 600 can be used to accommodate differently shaped breasts, as well as to provide different massaging effects to the breasts, such as, for example, different massaging members 634 formed on the

insert. Examples of some alternative inserts 600 are described more fully in copending U.S. Published Patent No. 20030149398, filed December 27, 2002, the disclosure of which has been incorporated by reference herein in its entirety.

While the preferred embodiment of the breast pump system uses breast cup 400 having a displacement volume 510 in fluid isolation from the user's breast, alternative breast cups can also be used with breast pump 100. The unique features of the breast pump system can be used with other types of breast cups, such as, for example, the control system or the rack and pinion driving mechanism.

Referring to Fig. 34, an alternative embodiment of the breast cup is shown and generally represented by reference numeral 5400. Breast cup 5400 is usable with insert 600. Breast cup 5400 has a funnel shaped housing 5500 that is connected to a cylindrically-shaped holder 5700. Holder 5700 has a handle 5725, a pressure orifice 5750, and a pressure adjuster 5775. Handle 5725 is ergonomically contoured and has a wave-like shape 5730 that provides for different holding angles. Handle 5725 is disposed along holder 5700 on the opposing side from funnel 5500. Handle 5725 is preferably made of, or covered by, a material that facilitates gripping. Handle 5725 can include various textures, projections and/or embossments to sooth the users hand during the pumping process.

Pressure orifice 5750 can be attached to tubing 350 to place breast cup 5400 in fluid communication with breast pump 100. Pressure adjuster 5775 is in fluid communication with pressure orifice 5750 and allows a user to adjust the pressure at the breast cup 5400 without having to make an adjustment at the breast pump 100. In this embodiment, pressure adjuster 5775 is a dial but alternative actuators can also be used.

Referring to Fig. 35, another alternative embodiment of the breast cup is shown and generally represented by reference numeral 6400. Breast cup 6400 is usable with

insert 600. Breast cup 6400 has a funnel 6500 that is connected to a holder 6700. Holder 6700 has handle portions 6725, 6726, a pressure orifice 6750, and a pressure adjuster 6775. Handle portions 6725, 6726 are disposed on opposing sides of holder 6700 and facilitate grasping of the holder. Handle portions 6725, 6726 are preferably made of, or covered by, a material that facilitates gripping. Handle portions 6725, 6726 can include various textures, projections and/or embossments to sooth the users hand during the pumping process.

Referring back to Fig. 12, holder 700 of breast cup 400 provides a first set of threads 701 and a second set of threads 702. First and second threads 701, 702 have different diameters and are sized to fit the two standard sized bottles or holders that are used with infant feeding and breast pumping, i.e., reusable containers and disposable containers. The first and second threads 701, 702 have the same pitch and are concentrically aligned. During the molding process, this allows the steel mold core to be unscrewed from holder 700.

While the embodiment illustrated shows the dual threads, i.e., first and second threads 701, 702 on breast cup 400, the use of the dual threads on other infant care products that require the use of a holder or bottle, such as, for example, a nipple ring or a cap is contemplated. Referring to Figs. 36 and 37, a nipple ring is shown and generally represented by reference numeral 7000. Nipple ring 7000 has a circumferential wall 7100 with an inwardly extending flange 7200 defining an opening 7250. Nipple ring 7000 has the dual threads described above, i.e., a first set of threads 701 and a second set of threads 702. The nipple ring 7000 provides for engagement of nipple 7500 with either reusable containers by way of first threads 701 or disposable containers by way of second threads 702. Preferably, first threads 701 downwardly extend from flange 7200 and second threads 702 are formed along circumferential wall 7100.

Referring to Figs. 38 and 39, a cap is shown and generally represented by reference numeral 8000. Cap 8000 has a circumferential wall 8100 connected to a top wall 8200. Cap 8000 also has the dual threads described above, i.e., a first set of threads 701 and a second set of threads 702. The cap 8000 provides sealing of either reusable containers by way of first threads 701 or disposable containers by way of second threads 702. Preferably, first threads 701 downwardly extend from top wall 8200 and second threads 702 are formed along circumferential wall 8100.

Referring to Fig. 13, T-connector 300 is a triangular shaped valve that allows a user to utilize either a single breast cup 400 or two breast cups through use of a first orifice 310 and a second orifice 320. Breast pump 100 is connected to t-connector 300 through air tubing 350 at inlet 330. The single split valve configuration of t-connector 300 minimizes the amount of tubing 350 necessary for double pumping. T-connector 300 has a plug 340 for closing off either of first or second orifices 310, 320 if single pumping is desired. Preferably, plug 340 is tethered to an outer surface of t-connector 300 to facilitate engagement with first or second orifices 310, 320.

Referring to Fig. 14, a method of expressing breast milk according to the breast pump system, is shown. The user commences the breast pumping operation by turning breast pump 100 "on," as in step 800. This causes power to be supplied to breast pump 100 (step 810). The user then inputs the cycle time and suction level that is desired, as in step 820. In the preferred embodiment, the user has five cycle times and suction levels from which to choose. The cycle time and suction level is inputted by use of button pad 105.

In step 830, PC board 120 sets the motor speed and target piston travel distance according to the user's inputted levels for cycle time and suction. The cycle time and suction level are then displayed to the user, as in step 840. In this embodiment, the cycle time and suction level are indicated by lights 225 with the number of illuminated lights

corresponding to the level. In step 850, motor 125 is actuated causing piston 112 to move toward bottom 175 of cylinder 113. This creates a positive pressure that is supplied to breast cup 400 by air tubing 350.

In step 855, the PC Board monitors the home switch to determine whether it has been triggered by contact with piston 112. In step 860, it is determined whether the home switch has been triggered. If the home switch has been triggered then it is reset as in step 870. In step 880, motor 125 is then reversed causing piston 112 to move toward top 180 of cylinder 113. This creates a negative pressure that is supplied to breast cup 400 by air tubing 350. One of the advantages of the breast pump system is that is supplies both a positive pressure and a negative pressure through the same air tubing 350. This reduces cleaning and simplifies the operation for a user.

To provide the proper amount of suction as inputted by the user, photo-sensors 121 count the number of rack openings 50, as in step 890. In step 900, PC board 120 determines if the number of rack openings 50 that have been counted is the equivalent of the target piston travel distance as inputted by the user. In step 910, it is determined whether breast pump 100 is still "on." If breast pump 100 has been shut off then the pumping operation ends, as in step 915.

In step 920, it is determined whether the user has inputted a new cycle time or suction level. If a new cycle time or suction level has been inputted, then PC Board 120 sets the motor speed and target piston travel distance according to the user's inputted levels for cycle time and suction, reverting back to step 830 and repeating the above described steps. If the user has not inputted a new cycle time or suction level then the motor is again reversed causing piston 112 to move toward bottom 175 of cylinder 113. This creates a positive pressure that is supplied to breast cup 400 by air tubing 350. The process continues with breast pump 100 supplying positive pressure and then negative pressure to breast cup 400 until the breast pump is shut off (step 910).

The breast pump system includes a number of components and can be used in remote locations, such as when a user is traveling. The various components can be disposed within a bag system for ease of use. An example of such a bag system, as well as the components of such a system, is disclosed in the co-pending and commonly owned U.S. Published Patent No. 20030149398, filed December 27, 2002, the disclosure of which is incorporated herein by reference.

The present invention having been thus described with particular reference to the preferred forms thereof, it will be obvious that changes may be made therein without departing from the scope of the present invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A breast pump for expressing breast milk from a breast, the pump comprising:

a pressure source having a movable structure for generating pressure during a pressure stroke, said movable structure having a variable pressure volume or variable cycle time; and

a controller operably connected to said pressure source, wherein said controller regulates said pressure volume based upon a distance traveled by said movable structure and regulates said variable cycle time based upon a speed of said movable structure, and wherein said controller provides substantially real-time monitoring of said distance traveled and said speed.

2. The pump of Claim 1, wherein said controller can regulate said pressure cycle based upon a non-sinusoidal wave signal of said pressure versus said variable cycle time.

3. The pump of Claim 2, wherein said non-sinusoidal wave signal comprises a square curve wave signal.

4. The pump of Claim 1, wherein said controller can regulate said pressure cycle based upon a sine wave signal of said pressure versus said variable cycle time.

5. The pump of Claim 1, wherein said pressure comprises both a positive pressure and a negative pressure.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference ElviePumpPCT	**FOR FURTHER ACTION** see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/GB2018/051659	International filing date *(day/month/year)* 15 June 2018 (15-06-2018)	(Earliest) Priority Date *(day/month/year)* 15 June 2017 (15-06-2017)
Applicant CHIARO TECHNOLOGY LIMITED		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 9 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed
      ☐ a translation of the international application into ____________ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☒ **Certain claims were found unsearchable** (See Box No. II)
3. ☒ **Unity of invention is lacking** (see Box No III)
4. With regard to the **title,**
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract,**
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority
6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 1
      ☒ as suggested by the applicant
      ☐ as selected by this Authority, because the applicant failed to suggest a figure
      ☐ as selected by this Authority, because this figure better characterizes the invention
   b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2018/051659

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 31-72(completely); 73-158(partially)
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-6, 11-14, 108-119(completely); 158(partially)

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2018/051659

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M1/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2016 010524 A (MURATA MANUFACTURING CO) 21 January 2016 (2016-01-21) abstract figures 1-5,8 -----	1-6, 11-14, 108-119, 158
X	US 2013/023821 A1 (KHALIL GAMAL [CH] ET AL) 24 January 2013 (2013-01-24) cited in the application page 3, paragraph 51-53 page 4, paragraph 66 - paragraph 69 figures 3-5,9-11 ----- -/--	1-6, 11-14, 108-119, 158

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 September 2018	04/12/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kempeneers, Johanna

2

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2018/051659

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2017/095599 A1 (KONDO DAISUKE [JP] ET AL) 6 April 2017 (2017-04-06) page 3, paragraph 55 - paragraph 57 page 7, paragraph 146 - page 8, paragraph 175 figures 1,15,16 -----	1,2,4-6, 108, 112-114, 158
A	US 2016/271305 A1 (KURIHARA KIYOSHI [JP] ET AL) 22 September 2016 (2016-09-22) page 3, paragraph 51 - paragraph 56 page 4, paragraph 61 page 6, paragraph 91 - paragraph 93 figures 1,2,6 -----	1,2,14, 118,158

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2018/051659

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2016010524 A	21-01-2016	NONE	
US 2013023821 A1	24-01-2013	AU 2012286462 A1	13-02-2014
		BR 112014001185 A2	21-02-2017
		CH 705295 A1	31-01-2013
		CN 103687634 A	26-03-2014
		EP 2734250 A1	28-05-2014
		IL 230280 A	28-06-2018
		JP 6062937 B2	18-01-2017
		JP 2014529312 A	06-11-2014
		KR 20140040232 A	02-04-2014
		MY 166874 A	24-07-2018
		PL 2734250 T3	31-03-2017
		RU 2014104019 A	27-08-2015
		TW 201304827 A	01-02-2013
		US 2013023821 A1	24-01-2013
		WO 2013010286 A1	24-01-2013
US 2017095599 A1	06-04-2017	JP 6213677 B2	18-10-2017
		JP WO2016002606 A1	27-04-2017
		US 2017095599 A1	06-04-2017
		WO 2016002606 A1	07-01-2016
US 2016271305 A1	22-09-2016	EP 3037116 A1	29-06-2016
		JP 6245280 B2	13-12-2017
		JP 2017205654 A	24-11-2017
		JP WO2015115516 A1	23-03-2017
		US 2016271305 A1	22-09-2016
		WO 2015115516 A1	06-08-2015

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6, 11-14, 108-119(completely); 158(partially)

   A wearable breast pump system as in claim 1, including special technical features of the piezo air-pump; A method of expressing and collecting milk, comprising the step of using such a wearable breast pump.

1.1. claims: 2(completely); 158(partially)

   A wearable breast pump system as in claim 1, configured as a self-contained wearable device with an internal rechargeable battery; A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

2. claims: 7-10, 120-127(completely); 158(partially)

   A wearable breast pump system as in claim 1, including special technical features of the diaphragm.

---

3. claims: 15, 27, 28, 30, 87-95(completely); 158(partially)

   A wearable breast pump system as in claim 1, including special technical features of the milk container; A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

4. claims: 16, 29, 73-86(completely); 158(partially)

   A wearable breast pump system as in claim 1, including special technical features of the breast shield; A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

5. claims: 17-19, 21, 23, 128-157(completely); 158(partially)

   A wearable breast pump system as in claim 1, including special technical features related to flow measurement and indication; A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

6. claims: 22(completely); 158(partially)

   A wearable breast pump system as in claim 1, in which the centre of gravity with an empty milk container attached to te housing is at or below (i) the half-way height line of the housing or (ii) the horizontal line passing through a nipple tunnel or filling point on a breast shield (so that

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

the device that is not top-heavy for a woman using the pump); A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

7. claims: 24(completely); 158(partially)

A wearable breast pump system as in claim 1, including a data sub-system that collects and provides data to a connected device or remote application or remote sensor; A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

8. claims: 20, 25, 26, 96-107(completely); 158(partially)

A wearable breast pump system as in claim 1, including special technical features of the pump (control); A method of expressing and collecting milk, comprising the step of using such a wearable breast pump

---

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 31-72(completely); 73-158(partially)

The present application contains 158 claims, of which 44 are independent.
There is no clear distinction between several of the 44 independent claims because of overlapping scope. Various independent claims directed to subject-matter that does not (completely) overlap do not meet the requirements of unity of invention (Rule 13 PCT).
According to what can be understood from the description, it seems that a protection is sought after for several a spects of a breast pump system:
- wearability (including a housing shaped at least in part to fit inside a bra)
- technical features of the breast shield
- technical features of the milk container
- technical features of the pump and its control to improve user comfort
- the pump is specifically a piezo air-pump (possibly two piezo air-pumps in series or in parallel), and details thereof
- a separate deformable diaphragm to generate negative air pressure inside the breast shield, the diaphragm as such separating the (piezo) air-pump from the breast shield such that the (piezo) air-pump forms part of a closed loop system
- a flow measurement and milk volume indication means

The 44 independent claims are either directed to one of the above aspects, or to what appears to be an aleatory mix and match of two or several of these aspects.
Moreover, from the 114 dependent claims, 85 claims are dependent on any of the 41 independent claims directed to a "system" (as well as on any of the other dependent claims). They too are directed to one of the above aspects, or to what appears to be an aleatory mix and match of two or several of these aspects.
There are thus so many claims, and they are drafted in such a way that the claims as a whole are not in compliance with the provisions of clarity and conciseness of Article 6 PCT, as it is particularly burdensome for a skilled person to establish the subject-matter for which protection is sought.
The non-compliance with the s ubstantive provisions is to such an extent, that the search was performed taking into consideration the non-compliance in determining the extent of the search (PCT Guidelines 9.19 and 9.25).
The search was based on the subject-matter that is expected to be claimed later in the procedure, and the corresponding independent claim 1. Moreover, independent claim 158, directed to a method of expressing and collecting milk, comprising the step of using a system as defined in claim 1, has also been searched. Independent claims 31-72 and independent claim 158 when referring to any of the independent

International Application No. PCT/ GB2018/ 051659

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

claims 31-72 were not searched. Claims 73-157 when being dependent on any of claims 31-72 were also not searched.
Since the claims dependent on claim 1 are not complying with unity of invention (Rule 13 PCT) (see non unity reasoning), the extent of the search was further limited to the technical features as claimed in claim 1 in combination with the first and second invention for which protection is sought, namely dependent claim 2 and the dependent claims further specifying details concerning the piezo air-pump (claims 3-6, 11-14, 108-119).

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

Electronic Patent Application Fee Transmittal

Application Number:	17203050
Filing Date:	16-Mar-2021
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Filer:	Kassity L. Mai/Scott Dodge
Attorney Docket Number:	ELVI-002/07US

Filed as Small Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	130	130
	Total in USD ($)			**130**

Electronic Acknowledgement Receipt

EFS ID:	44023302
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	58249
Filer:	Kassity L. Mai/Scott Dodge
Filer Authorized By:	Kassity L. Mai
Attorney Docket Number:	ELVI-002/07US
Receipt Date:	13-OCT-2021
Filing Date:	16-MAR-2021
Time Stamp:	17:33:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$130
RAM confirmation Number	E20210CH33514742
Deposit Account	501283
Authorized User	Scott Dodge

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	ELVI-002-07US_IDS_Transmittal.pdf	109637 b65db54bc85519642df8885a7bd57f1cf3c0cd0e	no	5
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	ELVI-002_07US_IDS_20211012171707.pdf	111290 e1e783c6fdf16345c71ec574ee32c1f6a8a1044a	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	CN101549180A_EFS.pdf	1275076 f54627a3a1fd62e612dbea1ab0f2629f45e1ee73	no	29
Warnings:					
Information:					
4	Foreign Reference	GB2435617B_EFS.pdf	1960765 a0a3627bb157bf6bb2c164b58166364714e910b0	no	67
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	002-04WO_ISR.pdf	313426 49ea1170aad053969aa0b9169bc61742644e1f12	no	9
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	37719 ef07e6378adefb57413e159b4f2c5811093b4ecc	no	2
Warnings:					

Information:	
Total Files Size (in bytes):	3807913

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Docket No.: ELVI-002/07US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Jonathan O'TOOLE	Confirmation No.:	3783
Application No.:	17/203,050	Group Art Unit:	9649
Filed:	March 16, 2021	Examiner:	Courtney B. FREDRICKSON

For: BREAST PUMP SYSTEM

VA EFS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.56, 1.97, AND 1.98

In accordance with the duty of disclosure set forth in 37 C.F.R. §1.56, Applicant hereby submits the following information in conformance with 37 C.F.R. §§1.97 and 1.98. It is respectfully requested that the information be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

[x] Pursuant to 37 C.F.R. §1.98, a copy of each non-US patent document at cite nos. 026, 028 and 032 on the attached Form used in lieu of PTO/SB/08 is enclosed.

[x] No copies of the foreign patent, foreign patent application, or non-patent literature publications listed on the attached Form used in lieu of PTO/SB/08 are being provided pursuant to 37 C.F.R. §1.98(d) except for cite nos. 026, 028 and 032 because the publications were previously cited by or submitted to the Office in prior Application Serial No(s). 17/181,057 and/or 16/009,547 to which the above-identified application claims priority under 35 U.S.C. §120.

[x] No copies of any U.S. patents or U.S. patent application publications listed on the attached Form used in lieu of PTO/SB/08 are being provided pursuant to 37 C.F.R. §1.98.

[] Publication(s) listed on the attached Form used in lieu of PTO/SB/08 were cited in a foreign search or examination report corresponding to application serial no. and mailed on .

[] Enclosed is a copy of a non-English publication(s) _____ Pursuant to §609 of the M.P.E.P., Applicant submits the attached foreign search or examination report, which cites such non-English language publication(s).

[] Enclosed is a copy of a non-English publication(s) _____ English language publication _____ (copy enclosed) claims priority from this non-English publication.

[] Enclosed is an explanation of non-English publication(s) _____ for which an English translation is not available.

[] Enclosed is an English translation of non-English publication(s) _____ cited on the attached Form used in lieu of PTO/SB/08.

[] Enclosed is an English language Abstract of non-English publication(s) _____ cited on the attached Form used in lieu of PTO/SB/08.

[] Enclosed is a copy of pending patent Application No. _____.

[] In accordance with **37 C.F.R. §1.97(b)**, no additional fee for submission of this Information Disclosure Statement is required, as it is filed within any one of the following time periods:

[] within three months from the filing date of this national application other than a CPA under 37 C.F.R. § 1.53(d);

[] within three months from the date of entry of the national stage as set forth in 37 C.F.R. §1.491 in this international application;

[] before the mailing date of a first Office action on the merits; or

[] before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114.

[x] In accordance with **37 C.F.R. §1.97(c)**, this Information Disclosure Statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing of any of the following: a final action under 37 C.F.R. §1.113; a notice of allowance under 37 C.F.R. §1.311; or an action that otherwise closes prosecution in this application.

In accordance with 37 C.F.R. §1.97(c) also enclosed is:

[] Fee under 37 C.F.R. §1.17(p) in the amount of $260.00;

[x] Fee under 37 C.F.R. §1.17(p) in the amount of $130.00;

[] Fee under 37 C.F.R. §1.17(p) in the amount of $65.00; or

[] Statement as specified in 37 C.F.R. §1.97(e):

[] Each item of information contained in the Information Disclosure Statement cited herein was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing date of the Information Disclosure Statement; or

[] No item of information contained in the Information Disclosure Statement submitted herewith was cited in any communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned, having made a reasonable inquiry, no item of information contained in the Information Disclosure Statement was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing date of the Information Disclosure Statement.

[] This Information Disclosure Statement is filed after payment of the issue fee, but before issuance of the patent under the Quick Path Information Disclosure Statement pilot program.

In accordance with the Quick Path Information Disclosure Statement pilot program also enclosed is:

[] Fee under 37 C.F.R. §1.17(p) in the amount of $260.00;

[] Fee under 37 C.F.R. §1.17(p) in the amount of $130.00;

[] Fee under 37 C.F.R. §1.17(p) in the amount of $65.00;

and

[] Statement as specified in 37 C.F.R. §1.97(e):

[] Each item of information contained in the Information Disclosure Statement cited herein was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing date of the Information Disclosure Statement; or

[] No item of information contained in the Information Disclosure Statement submitted herewith was cited in any communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned, having made a reasonable inquiry, no item of information contained in the Information Disclosure Statement was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing date of the Information Disclosure Statement.

[] In accordance with **37 C.F.R. §1.97(d)**, this Information Disclosure Statement is filed after the period specified in 37 C.F.R. § 1.97(c), but with or before the payment of the issue fee.

In accordance with 37 C.F.R. §1.97(d) also enclosed is:

[] Fee under 37 C.F.R. §1.17(p) in the amount of $260.00;

[] Fee under 37 C.F.R. §1.17(p) in the amount of $130.00; or

[] Fee under 37 C.F.R. §1.17(p) in the amount of $65.00;

and

[] Statement as specified in 37 C.F.R. §1.97(e):

[] Each item of information contained in the Information Disclosure Statement cited herein was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing date of the Information Disclosure Statement; or

[] No item of information contained in the Information Disclosure Statement submitted herewith was cited in any communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned, having made a reasonable inquiry, no item of information contained in the Information Disclosure Statement was known to any individual designated in 37 C.F.R. §1.56(c) more than three months prior to the filing date of the Information Disclosure Statement.

[] In accordance with **37 C.F.R. § 1.704(d)**, Applicant notes that to our knowledge each item of information contained in the information disclosure statement:

[] was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and this communication was not received by any individual designated in § **1.56(c)** more than thirty days prior to the filing of the information disclosure statement.

[] is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § **1.56(c)** more than thirty days prior to the filing of the information disclosure statement.

In accordance with 37 C.F.R. § 1.97(g), this Information Disclosure Statement shall not be construed as to mean that a search has been made.

In accordance with 37 C.F.R. § 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that the information cited in the statement is, or is considered to be material to patentability as defined by 37 C.F.R § 1.56(b).

REMARKS

It is respectfully requested that the Examiner consider the above-noted information and return an initialed copy of the attached Form used in lieu of PTO/SB/08 to the undersigned.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Director is hereby authorized to charge any additional fees which may be required with respect to this communication, or credit any overpayment, to Deposit Account No. 50-1283, under Order No. ELVI-002/07US.

Dated: October 13, 2021

Respectfully submitted,
COOLEY LLP

Electronic signature: /Kassity L. Mai/
Kassity L. Mai
Reg. No. 68,774

USPTO CUSTOMER NO. 58249

COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue NW, Suite 700
Washington, DC 20004

Tel: (617) 937-2300
Fax: (202) 842-7899

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US	9649

58249 7590 11/04/2021
COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue, NW
Suite 700
Washington, DC 20004

EXAMINER	
FREDRICKSON, COURTNEY B	

ART UNIT	PAPER NUMBER
3783	

NOTIFICATION DATE	DELIVERY MODE
11/04/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

zIPPatentDocketingMailboxUS@cooley.com

Office Action Summary	**Application No.** 17/203,050	**Applicant(s)** O'TOOLE et al.	
	Examiner COURTNEY FREDRICKSON	**Art Unit** 3783	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 24Septembe2021.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-11 and 13-31 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☑ Claim(s) 1-11,13-16 and 19-30 is/are allowed.

7) ☑ Claim(s) 17-18 and 31 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 16March2021 is/are: a)☑ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a)☑ All b)☐ Some** c)☐ None of the:
1.☑ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Information Disclosure Statement

The information disclosure statement (IDS) submitted is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Response to Amendment

This office action is responsive to the amendment filed on September 24, 2021. As directed by the amendment: claims 1-5, 7, 8, 11, 14, 15, 17, 18, 20, 21, 23, 25-27, 29, and 30 have been amended, claim 12 has been cancelled, and claim 31 has been added. Thus, claims 1-11 and 13-31 are presently pending in this application.

Applicant's amendments to the Specification, Drawings, and Claims have overcome each and every objection and 112(b) rejections previously set forth in the Non-Final Office Action mailed June 24, 2021.

Response to Arguments

Applicant's arguments with respect to the claims have been considered but are moot because the arguments do not apply to the current grounds of rejection as necessitated by applicant's amendments.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 18 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

Regarding claim 18, it is unclear if “a diaphragm holder” in line 2 is the same as the holder recited in claim 1 or if the claim intends to introduce a different diaphragm holder. For the purpose of indicating allowable subject matter, the claim is interpreted as meaning a second diaphragm holder. The examiner notes that this interpretation appears consistent with Applicant’s invention in fig. 4 of the Drawings which show a different diaphragm holder 19A as being situated above the breast flange and the nipple tunnel.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the

claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 31 is/are rejected under 35 U.S.C. 103 as being unpatentable over Khalil (US 20130023821) in view of Makower (US 20170072118).

Regarding claim 31, Khalil discloses a breast pump device that is configured as a self-contained, in-bra wearable device (figs. 9-11; paragraph 70), the breast pump device comprising: (i) a housing (shell units 6' and 6" form a housing in fig. 9) that includes (a) a power source (paragraph 67), and (b) a pump generating negative air pressure (81 in fig. 10); (ii) a breast shield (1 in fig. 11) made up of a breast flange (12 in fig. 4) and a nipple tunnel (13 in fig. 3); (iii) a milk container that is configured to be attached to and removed from the housing (7' in fig. 11); and (iv) a diaphragm (3 in fig. 11) configured to be sealed with respect to an external portion of the housing (figs. 4 and 5 show the diaphragm 3 sealed inside the diaphragm housing portions 2 and 3 so that the diaphragm is considered sealed with respect to the outer surface of shell 6"), the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel (paragraph 61).

However, Khalil does not teach or disclose the power source being a battery which powers the pump.

Makower is directed toward a similar breast pump (fig. 1b) which has a battery (48 in fig. 14a) that powers the pump (paragraph 12). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the power source of Khalil to be a battery which powers the pump, as taught by Makower, for the purpose of enabling the system to be used without being plugged into an AC source.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory

double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claim 17 rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 10,881,766 in view of Khalil, Makower, and Meyers (US 5542921).

Claim 1 of the issued patent discloses all of the claimed limitations of claim 17 except the device being a self-contained, in-bra wearable device that includes a power charging circuit for controlling the charging of the rechargeable battery; control electronics powered by the rechargeable battery; and the pump being powered by the rechargeable battery.

Khalil teaches a breast pump device (fig. 10) configured as a self-contained, in-bra wearable device (fig. 10; paragraph 70). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the reference claim to be a self-contained, in-bra wearable device, as taught by Khalil, for the purpose of enabling the device to be a small and hands-free (paragraph 70).

Makower teaches a similar breast pump device (fig. 1A) having a rechargeable battery (battery 48 in fig. 14A; paragraph 154, lines 8-22 discloses the battery being rechargeable), control electronics powered by the rechargeable battery (paragraph 12 discloses a controller powered by the battery; paragraph 11, lines 1-5 discloses the controller being in the main body 34); a pump powered by the rechargeable battery and generating negative air pressure (paragraph 12 discloses a pumping mechanism powered by the battery and generating suction; paragraph 11, lines 1-5 discloses the pump being in main body 34). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the pump and the control electronics to be powered by the rechargeable battery for the purpose of rendering the pump and control electronics operable.

Meyers is directed towards a breast pump system (fig. 2) which comprises rechargeable batteries (107A in fig. 5A) and a power charging circuit for controlling the charging of the battery (9:50-52 discloses a circuit recharges batteries). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the claim of the reference patent to include the

circuit for controlling the charging of the battery, as taught by Meyers, to enable charging of the battery while operating the device (9:50-52).

Claim 17 rejected on the ground of nonstatutory double patenting as being unpatentable over claim 32 of U.S. Patent No. 10926011 in view of Khalil, Makower, and Meyers.

Claim 32 of the issued patent discloses all of the claimed limitations of claim 1 of the application except being the device being a self-contained, in-bra wearable device that includes a power charging circuit for controlling the charging of a rechargeable battery; control electronics powered by the rechargeable battery; and the air pumps being powered by the rechargeable battery, the breast shield having a breast flange and nipple tunnel including guide lines running parallel to the sides of the nipple tunnel; and the milk container being configured to be attached and removed from the housing.

Additionally, claim 1 of the issued patent includes additional features not recited in the application claims, thus the patent claim is more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993).

Khalil teaches a breast pump device (fig. 10) configured as a self-contained, in-bra wearable device (fig. 10; paragraph 70) having a breast shield (1 in fig. 11) having a flange (12in fig. 6) and a nipple tunnel (13 in fig. 6) and a milk container (7’ in fig. 11) configured to be attached and removed from the housing (paragraph 69). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the reference claim to be a self-contained, in-bra wearable device having a breast shield with a flange and nipple tunnel and a milk

container configured to be attached and removed from the housing, as taught by Khalil, for the purpose of enabling the device to be a small and hands-free (paragraph 70). The modification of the breast shield would enable the shield to interface with the breast and receive the nipple and the modification of the milk container would enable the milk to be collected after expression.

Makower teaches a similar breast pump device (fig. 1A) having a rechargeable battery (battery 48 in fig. 14A; paragraph 154, lines 8-22 discloses the battery being rechargeable), control electronics powered by the rechargeable battery (paragraph 12 discloses a controller powered by the battery; paragraph 11, lines 1-5 discloses the controller being in the main body 34), and a pump powered by the rechargeable battery and generating negative air pressure (paragraph 12 discloses a pumping mechanism powered by the battery and generating suction; paragraph 11, lines 1-5 discloses the pump being in main body 34). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the pump and the control electronics to be powered by a rechargeable battery for the purpose of rendering the pump and control electronics operable and to enable the power source to be reused.

Meyers is directed towards a breast pump system (fig. 2) which comprises rechargeable batteries (107A in fig. 5A) and a power charging circuit for controlling the charging of the battery (9:50-52 discloses a circuit recharges batteries). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the claim of the reference patent to include the

circuit for controlling the charging of the battery, as taught by Meyers, to enable charging of the battery while operating the device (9:50-52).

Claim 17 is provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 27 of copending Application No. 17203109 in view of Makower and in view of Meyers.

Regarding claim 17, claim 27 of the ‘109 patent application claims all of the claimed limitations set forth in claim 17 of the instant application except in that claim 27 of the ‘109 application does not teach or disclose a rechargeable battery, a power charging circuit for controlling the charging of the rechargeable battery; and control electronics powered by the rechargeable battery.

Makower teaches a similar breast pump device (fig. 1A) having a rechargeable battery (battery 48 in fig. 14A; paragraph 154, lines 8-22 discloses the battery being rechargeable), control electronics powered by the rechargeable battery (paragraph 12 discloses a controller powered by the battery; paragraph 11, lines 1-5 discloses the controller being in the main body 34), and a pump powered by the rechargeable battery and generating negative air pressure (paragraph 12 discloses a pumping mechanism powered by the battery and generating suction; paragraph 11, lines 1-5 discloses the pump being in main body 34). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the pump and the control electronics to be powered by a rechargeable battery for the purpose of rendering the pump and control electronics operable and to enable the power source to be reused.

Meyers is directed towards a breast pump system (fig. 2) which comprises rechargeable batteries (107A in fig. 5A) and a power charging circuit for controlling the charging of the battery (9:50-52 discloses a circuit recharges batteries). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified the claim of the reference application to include the circuit for controlling the charging of the battery, as taught by Meyers, to enable charging of the battery while operating the device (9:50-52).

Claim 17 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 13 of copending Application No. 17203150 (reference application).

Although the claims at issue are not identical, they are not patentably distinct from each other because the reference claim contains all of the claimed limitations of the instant application. An additional difference between claim 17 of the application and claim 13 of the reference application lies in the fact that claim 13 of the reference application includes more features and is therefore more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993). Since the application claim is anticipated by the patent claim, it is not patentably distinct therefrom.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim 17 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 21 of copending Application No. 17203179 (reference application).

Although the claims at issue are not identical, they are not patentably distinct from each other because the reference claim contains all of the claimed limitations of the instant application. An additional difference between claim 17 of the application and claim 21 of the reference application lies in the fact that claim 21 of the reference application includes more features and is therefore more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993). Since the application claim is anticipated by the patent claim, it is not patentably distinct therefrom.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim 17 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 13 of copending Application No. 17203313 (reference application).

Although the claims at issue are not identical, they are not patentably distinct from each other because the reference claim contains all of the claimed limitations of the instant application. An additional difference between claim 17 of the application and claim 25 of the reference application lies in the fact that claim 25 of the reference application includes more features and is therefore more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993). Since the application claim is anticipated by the patent claim, it is not patentably distinct therefrom.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim 17 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 13 of copending Application No. 17203355 (reference application).

Although the claims at issue are not identical, they are not patentably distinct from each other because the reference claim contains all of the claimed limitations of the instant application. An additional difference between claim 17 of the application and claim 13 of the reference application lies in the fact that claim 13 of the reference application includes more features and is therefore more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993). Since the application claim is anticipated by the patent claim, it is not patentably distinct therefrom.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim 17 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 13 of copending Application No. 17203397 (reference application).

Although the claims at issue are not identical, they are not patentably distinct from each other because the reference claim contains all of the claimed limitations of the instant application. An additional difference between claim 17 of the application and claim 13 of the reference application lies in the fact that claim 13 of the reference application includes more features and is therefore more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d

2010 (Fed. Cir. 1993). Since the application claim is anticipated by the patent claim, it is not patentably distinct therefrom.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim 17 provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 13 of copending Application No. 17203418 (reference application).

Although the claims at issue are not identical, they are not patentably distinct from each other because the reference claim contains all of the claimed limitations of the instant application. An additional difference between claim 17 of the application and claim 13 of the reference application lies in the fact that claim 13 of the reference application includes more features and is therefore more specific. It has been held that the specific invention anticipates the generic invention. See *In re Goodman*, USPQ2d 2010 (Fed. Cir. 1993). Since the application claim is anticipated by the patent claim, it is not patentably distinct therefrom.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Claim 31 is provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of copending Application No. 17181057, 17203079, 17203179, 17203216, 17203259, 17203292, 17203313, 17203327, 17203355, 17203384, 17203397, 17203418 in view of Khalil.

Regarding claim 31, claim 1 of the aforementioned patent applications claim all of the claimed elements of claim 31 of the instant application except a diaphragm

configured to be sealed with respect to an external portion of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel.

Khalil teaches a diaphragm (3 in fig. 11) configured to be sealed with respect to an external portion of the housing (figs. 4 and 5 show the diaphragm 3 sealed inside the diaphragm housing portions 2 and 3 so that the diaphragm is considered sealed with respect to an outer surface of shell 6”), the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel (paragraph 61). Therefore, it would have been obvious to one of ordinary skill before the effective filing date of the claimed invention to have modified claim 1 of the reference applications to claim a diaphragm configured to be sealed with respect to an external portion of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel, as Khalil teaches that this configuration provides the benefit of ensuring that the pump and underpressure chamber remain unchanged and ensures a uniform pump output (paragraph 31)

This is a provisional nonstatutory double patenting rejection.

Allowable Subject Matter

Claims 1-11, 13-16, and 19-30 are allowed over the prior art of record.

Claim 18 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: The claims in this application are allowed because the prior art of record fails to disclose either singly or in combination the claimed breast pump device.

The closest prior art of record is Khalil.

Regarding independent claim 1, Khalil fails to teach among all the limitations or render obvious a diaphragm configured to be seated against a diaphragm holder that forms a recess or cavity at least in part with an external surface of the housing, in combination with the total structure and function as claimed. Instead, Khalil teaches a diaphragm (3 in fig. 11) which is seated against a diaphragm holder (2 and 4 in fig. 11). However, this sub-assembly is shown to be fully positioned within the housing so that it is enclosed by the housing and cannot be considered to form a recess for cavity with an external surface of the housing.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Excepting the double patenting rejections above, **claim 17** would be allowable over the prior art of record. The reasons for allowance is provided in the Non-Final Rejection mailed on June 24, 2021.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY FREDRICKSON whose telephone number is (571)270-7481. The examiner can normally be reached Monday-Friday (9 AM - 5 PM EST).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, NATHAN PRICE can be reached on 571-270-5421. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is

available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY B FREDRICKSON/
Examiner, Art Unit 3783

/NATHAN R PRICE/
Supervisory Patent Examiner, Art Unit 3783

Search Notes	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.
	Examiner COURTNEY FREDRICKSON	Art Unit 3783

CPC - Searched*		
Symbol	**Date**	**Examiner**
a61m1/06, 1/062, 1/066; a61j13/00; a41c4/04	06/19/2021	cbf

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
see SEARCH history	06/19/2021	cbf
searched inventors in SEARCH and PALM	06/19/2021	cbf
Consulted parent history	06/19/2021	cbf
Updated search	10/25/2021	cbf

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783	

Index of Claims	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.
	Examiner COURTNEY FREDRICKSON	Art Unit 3783

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2021	10/25/2021							
	1	✓	=							
	2	✓	=							
	3	✓	=							
	4	✓	=							
	5	✓	=							
	6	✓	=							
	7	✓	=							
	8	✓	=							
	9	✓	=							
	10	✓	=							
	11	✓	=							
	12	✓	-							
	13	✓	=							
	14	✓	=							
	15	✓	=							
	16	✓	=							
	17	✓	✓							
	18	✓	✓							
	19	✓	=							
	20	✓	=							
	21	✓	=							
	22	✓	=							
	23	✓	=							
	24	✓	=							
	25	✓	=							
	26	✓	=							
	27	✓	=							
	28	✓	=							
	29	✓	=							
	30	✓	=							
	31		✓							

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	17/203,050
Filing Date	March 16, 2016
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	ELVI-002/07US

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2 (if known)]	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-7666162	02-23-2010	RENZ; Charles J. et al.	
	002	US-8608685	12-17-2013	TASHIRO; Mitsuo et al.	
	003	US-10881766	01-05-2021	O'TOOLE; Jonathan et al.	
	004	US-10926011	02-23-2021	O'TOOLE; Jonathan et al.	
	005	US-20040087898	05-06-2004	WENIGER; Gotthilf	
	006	US-20090281482	11-12-2009	BAKER; Peter Christensen et al.	
	007	US-20100292636	11-18-2010	RENZ; Charles J. et al.	
	008	US-20120165729	06-28-2012	CUDWORTH; Nicholas	
	009	US-20140263611	09-18-2014	BAUER; Ryan	
	010	US-20160228625	08-11-2016	HOLTZ; Raymond et al.	
	011	US-20180110900	04-26-2018	KORENFELD; Michael S.	
	012	US-20210170080	06-10-2021	O'TOOLE; Jonathan et al.	
	013	US-20210196874	07-01-2021	O'TOOLE; Jonathan et al.	
	014	US-20210196875	07-01-2021	O'TOOLE; Jonathan et al.	
	015	US-20210196876	07-01-2021	O'TOOLE; Jonathan et al.	
	016	US-20210205511	07-08-2021	O'TOOLE; Jonathan et al.	
	017	US-20210205512	07-08-2021	O'TOOLE; Jonathan et al.	
	018	US-20210205513	07-08-2021	O'TOOLE; Jonathan et al.	
	019	US-20210205514	07-08-2021	O'TOOLE; Jonathan et al.	
	020	US-20210205515	07-08-2021	O'TOOLE; Jonathan et al.	
	021	US-20210205516	07-08-2021	O'TOOLE; Jonathan et al.	
	022	US-20210205517	07-08-2021	O'TOOLE; Jonathan et al.	
	023	US-20210205518	07-08-2021	O'TOOLE; Jonathan et al.	
	024	US-20210228789	07-29-2021	O'TOOLE; Jonathan et al.	
	025	US-20210268158	09-02-2021	O'TOOLE; Jonathan et al.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)	Application Number	17/203,050
	Filing Date	March 16, 2016
	First Named Inventor	Jonathan O'TOOLE
	Art Unit	3783
	Examiner Name	Courtney B. FREDRICKSON
Sheet 2 of 3	Attorney Docket Number	ELVI-002/07US

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	026	CN-101549180-A	10-07-2009	PIGEON CORP [JP]	Corresponds to US8608685	☒
	027	EP-0503280-A2	09-16-1992	PIERBURG GMBH [DE]		☒
	028	GB-2435617-B	03-05-2008	PLAYTEX PRODUCTS INC [US]		☐

Examiner Signature	/COURTNEY B FREDRICKSON/	Date Considered	10/25/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	3	of	3

Complete if Known	
Application Number	17/203,050
Filing Date	March 16, 2016
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	ELVI-002/07US

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	029	GB Search Report, dated 15 November 2017, issued in priority GB Application No. GB1709561.3.	☐
	030	GB Search Report, dated 28 November 2017, issued in priority GB Application No. GB1709566.2.	☐
	031	GB Search Report, dated 29 November 2017, issued in priority GB Application No. GB1709564.7.	☐
	032	International Search Report issued in PCT/GB2018/051659 dated December 4, 2018, 9 pages.	☐

Examiner Signature	/COURTNEY B FREDRICKSON/	Date Considered	10/25/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	268	a61m1/$.cpc. AND ((breast milk) WITH pump$4) AND ((power$4 battery) WITH (charg$4 recharg$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/12 04:05 PM
L2	65	("20020193731"|"20040056641"|"20040074281"|"20040267215"|"20050219302"|"20060122575"|"20070051172"|"20070051727"|"20080262420"|"20120277636"|"20140052056"|"20150217036"|"20150217037"|"20150283311"|"20160000980"|"20160058929"|"20160082165"|"20160082166"|"20160151551"|"20160158424"|"20160206794"|"20160220743"|"20160220745"|"20160287767"|"20160296681"|"20160310650"|"20170021068"|"20170035951"|"20170143879"|"20170220753"|"20180021490"|"2849881"|"4390024"|"5474683"|"5941847"|"5973770"|"6045529"|"6090065"|"6383163"|"6440100"|"6461324"|"6547756"|"6579258"|"6663587"|"6749582"|"7048519"|"7201735"|"7312554"|"7314400"|"7776008"|"8057425"|"8118772"|"8187227"|"8262606"|"8282596"|"8376986"|"8702646"|"8801495"|"8876760"|"8926556"|"9033913"|"9173587"|"9345274"|"9539377"|"D548831").PN.	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/07 01:17 PM
L3	214	(jonathan near3 o'toole).inv. (adam near3 rollo).inv. (andrew near3 carr).inv.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 01:42 PM
L4	63	(a61m1/062 a61m1/066 a61m1/06).cpc. and	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2018/08/07 01:45 PM

		piezo$9	JPO)				
L5	19	("20040122358" | "20060226108" | "20080077042" | "20080167579" | "20120004603" | "3895533" | "4024856" | "4338953" | "5347656" | "5666104" | "5827191" | "7316653" | "7621797" | "7794425" | "8308648" | "8777864" | "8801658" | "8827911").PN. OR ("8992445").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/07 01:50 PM
L6	7	("5730139" | "6423010" | "6602199" | "7479154" | "8206414" | "8425426" | "8992445").PN. OR ("9192325").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/07 01:59 PM
L7	582	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:16 PM
L8	3369	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:58 PM
L9	2787	(a61m1/062 a61m1/066 a61m1/06).cpc. not L7	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:58 PM
L10	45	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/07 02:59 PM

		20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$).did. or (WO-2015174330-$ or WO-2016024558-$).did.					
L11	14	L10 and (pump$4 same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:59 PM
L12	2	"60479361".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/07 03:04 PM
L13	143	a61j13/00.cpc.	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/10 10:30 AM
L14	409	a61j13/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:30 AM
L15	3369	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:43 AM
L16	582	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L17	0	(a61m1/062 a61m1/066 a61m1/06).cpc. not (L16 L15)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L18	2665	(a61m1/062 a61m1/066 a61m1/06).cpc. not (L16 L14)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L19	71	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 11:47 AM

		US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$).did.					

L20	37	L19 and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 11:48 AM
L21	4	L19 and ((air with pump$4) same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 11:50 AM
L22	16	L19 and (pump$4 same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 12:15 PM
L23	1	L19 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 12:40 PM
L24	0	a61m1/1058.cpc. and breast and diaphragm	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 12:42 PM
L25	5	breast same pump$4 same piezo$8 same air	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 12:43 PM
L26	1	("9884172").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/10 01:58 PM
L27	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:40 AM
L28	2	"59563385".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:20 AM
L29	1	"59563425".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:20 AM
L30	87	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:26 AM

		20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$).did.					
L31	44	L30 and (air with	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/24

		pump$4)	USOCR; FPRS; EPO; JPO)				10:26 AM
L32	17	L30 and (pump$4 with diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 10:27 AM
L33	51	L27 and "air pump"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 11:07 AM
L34	4	"47900902".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 11:13 AM
L35	10	("20030212374" | "20050251089" | "20050283900" | "20070135778" | "20110054389" | "3084691" | "4229029" | "5295957" | "6070659").PN. OR ("9511176").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/24 11:16 AM
L36	2	"51149640".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 11:17 AM
L37	271	L27 and (control$4 same select$4 left same right same breast)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 12:50 PM
L38	3	L30 and (recharg$4 with battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 01:04 PM
L39	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:41 PM
L40	9	L39 and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:41 PM
L41	11	L39 and (light with milk with (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:48 PM
L42	0	L39 and (radiation with milk with (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:51 PM
L43	2	L39 and (radiation same milk same (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:51 PM
L44	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:13 PM
L45	10	L44 and ((piezo piezoelectric piezo-electric) same air same pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:13 PM
L46	1	a61m1/1058 and	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/24

		(suction$4 vacuum$4 aspirat$4)	USOCR; FPRS; EPO; JPO)				07:23 PM
L47	27	a61m1/1058.cpc. and (suction$4 vacuum$4 aspirat$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:23 PM
L48	23	L44 and (indicator same milk same (express$4 flow$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:26 PM
L49	51	L44 and (air same pressure same sens$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:30 PM
L50	19	L44 and ((indicat$4 record$4) same (right and left))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:38 PM
L51	56	L44 and (pump$4 with series)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:42 PM
L52	77	L44 and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:47 PM
L53	87	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 07:59 PM

		20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$).did.					
L54	44	L53 and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:59 PM
L55	5	L54 and (air with filter$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:59 PM

L56	3	L44 and (pump$4 with (db decibal?))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:07 PM
L57	6	L44 and ((db decibal?))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:07 PM
L58	26	L44 and (sens$4 with (orientation angle tilt placement))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:16 PM
L59	9	L44 and ((indicat$4 input$4 document$4 record$4) with comfort)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:31 PM
L60	484	a61m$/$.cpc. and ((indicat$4 input$4 document$4 record$4) with comfort)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:32 PM
L61	1	L44 and "social media"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:52 PM
L62	408	a61m$/$.cpc. and ((piezo piezoelectric piezo-electric) same air same pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:13 PM
L63	3606	a61m$/$.cpc. and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:18 PM
L64	359	a61m$/$.cpc. and ((pump$4 with weigh$4) same (portable lightweight carry$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:30 PM
L65	1	("20160166745").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/25 07:16 PM
L66	1	("20160058928").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/25 07:23 PM
L67	1	("20110004154").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/26 10:55 AM
L68	96	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/26 11:09 AM

		US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-					

		8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L69	2	L69 and (radiation same (height quantity amount volume))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/26 11:09 AM
L70	96	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/26 12:24 PM

		20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-					

		2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L71	3	L71 and ((diaphragm membrane) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/26 12:24 PM
L72	3606	a61m$/$.cpc. and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:09 PM
L73	137	L73 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:09 PM
L74	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:10 PM
L75	9	L75 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:10 PM
L76	19	L75 and (shield with snap$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:16 PM
L77	1	("20110152855").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 01:20 PM
L78	32	L75 and (flow with rate with air)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:33 PM
L79	3	L75 and (stall with pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:56 PM
L80	98	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/27 01:56 PM

		US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$).did. or (WO-2015174330-$ or					

		WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L81	17	L81 and (pressure same (mmhg kpa mbar pa bar))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:57 PM
L82	18	(("7550034") or ("8123502") or ("8297947") or ("8371829") or ("8409160") or ("8646479") or ("8734131") or ("8763633") or ("8821134") or ("9051931") or ("9127665") or ("9239059") or ("9279421") or ("9334858") or ("9506463") or ("9752565") or ("9709042") or ("9777851")).PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 02:08 PM
L83	0	L83 and breast	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:08 PM
L84	10	L83 and (lactat$3 milk)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:08 PM
L85	14	L81 and (piezo piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:10 PM
L86	5	L75 and ((piezo piezoelectric) with air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:47 PM
L87	230	(((piezo piezoelectric) with air with pump$4) same (miniature small compact lightweight))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:48 PM
L88	6	L88 and (breast milk lactat$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:53 PM

L89	161	a61m$/$.cpc. and ((piezo piezoelectric piezo-electric) with air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:11 PM
L90	0	(2017/0072118).CCLS.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:19 PM
L91	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:19 PM
L92	40	(((piezo piezoelectric) with air with pump$4) same (miniature small compact lightweight)) same (vacuum$4 suction$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:22 PM
L93	3	"45513973".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/27 03:23 PM
L94	364	(((piezo piezoelectric) with pump$4) same (miniature small compact lightweight)) same (vacuum$4 suction$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:32 PM
L95	3	"20170035951"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:33 PM
L96	1	L96 and (suction$4 with piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:34 PM
L97	1	("20130064683").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:38 PM
L98	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:39 PM
L99	1	(US-20170172485-$).did.	(US-PGPUB)	OR	OFF	OFF	2018/08/28 04:48 PM
L100	0	L100 and "function of"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 04:48 PM
L101	100	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/28 05:19 PM

		US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-					

		7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L102	0	L102 and ((meaur$4 with milk) same rate)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:20 PM
L103	0	L102 and ((meaur$4 with milk) same (frequency speed))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:20 PM
L104	16	L102 and ((measur$4 with milk) same (frequency speed rate))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:21 PM
L105	0	L102 and ((measur$4 with milk) with "function of")	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:23 PM
L106	6	L102 and (decrease with (rate speed frequency strong))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:10 PM
L107	2	L102 and (latch$4 with adjust$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:22 PM
L108	50	(a61m$/$).cpc. and (wear$4 with pump$4) and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:24 PM
L109	0	(a61m$/$).cpc. and (wear$4 with pump$4) and (((center centre) with gravity) same comfort$5)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:25 PM
L110	83	(a61m$/$).cpc. and (((center centre) with gravity) same	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:26 PM

		comfort$5)					
L111	101	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 09:43 AM

		US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L112	3	L112 and (shield with (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:43 AM
L113	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:47 AM
L114	86	L114 and ((diapragm housing) with (housing case mount$4) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:53 AM
L115	9	L114 and ((diapragm membrane) with (housing case mount$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:54 AM

		with shield)					
L116	34	L112 and (diaphragm membrane)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:07 AM
L117	28	L114 and (diaphragm membrane) and (shield with dispos$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:10 AM
L118	28	L114 and ((diaphragm membrane) with (coupl$4 attach$4 mount$4) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:23 AM
L119	0	a61j16/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:41 AM
L120	409	a61j13/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:42 AM
L121	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:23 PM
L122	23	L122 and (sens$4 same (orient$4 plac$4 situat$4) same (nipple shield))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:23 PM
L123	11	L122 and ((sens$4 accelerometer) with breast with (move moved moving movement))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:32 PM
L124	10	L122 and accelerometer	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:33 PM
L125	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 02:27 PM
L126	259	L122 and ((lower$4 decrea$4) with (suction$4 intens$4 pain comfort discomfort))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 02:51 PM
L127	45	L122 and ((lower$4 decrea$4) with (intens$4 pain comfort discomfort))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 02:59 PM
L128	11	(a61m$/$.cpc.) and ((miniature compact small) same (piezoelectric piezo-electric piezo) same pump$4 same (suction$4 vacuum$4) same (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 03:40 PM
L129	127	L122 and ((pressure	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/29

		suction$4) with (mmhg kpa mbar pa bar))	USOCR; FPRS; EPO; JPO)				05:16 PM
L130	2	"60479361".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 05:29 PM
L131	106	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 05:31 PM

		20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L132	104	L132 and @ad<="20170615"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 05:32 PM
L133	14	(US-20160166745-$ or	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/29

		US-20150283311-$ or US-20180110906-$ or US-20140378895-$ or US-20140031744-$ or US-20160220743-$ or US-20160256617-$ or US-20080177224-$ or US-20130023821-$ or US-20160058928-$ or US-20170043065-$ or US-20110004154-$).did. or (US-10039871-$ or US-6358226-$).did.					06:08 PM
L134	1	"52574056".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 06:46 PM
L135	0	("2009024080").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 06:53 PM
L136	1	("20090024080").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 06:53 PM
L137	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 07:30 PM
L138	203	L138 and ((shield nipple) with (remov$4 replac$4 clean$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 07:30 PM
L139	1	("4535627").PN.	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/01/08 12:52 PM
L140	74	(("20180361040") or ("20180236147") or ("20120277728") or ("7785305") or ("20080208116") or ("7223255") or ("7789865") or ("8118772") or ("20080275385") or ("9956331") or ("8057425") or ("20070219486") or ("20020193731") or ("10046097") or ("20140378946") or ("20180326130") or ("20120316493") or ("8568350") or ("20030191427") or ("8070716") or ("9539377") or ("20160303298") or ("20160206794") or ("9539376") or ("20160310649") or ("20160287769") or ("20160310650") or ("20180001002") or	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/01/08 12:54 PM

		("20090099511") or ("7776008") or ("20090062731") or ("20160296682") or ("20050154349") or ("20030191433") or ("5749850") or ("20100292636") or ("7559915") or ("20080262420") or ("20160325031") or ("20170173232") or ("7749188") or ("6887217") or ("6139521") or ("20180021490") or ("20150065994") or ("20180028732") or ("20150196460") or ("9636282") or ("7758540") or ("8945046") or ("20080243059") or ("20110251552") or ("20170119942") or ("20130023821") or ("6997897") or ("9033913") or ("20150157776") or ("20090254028") or ("5514166") or ("20010038799") or ("20070161947") or ("20130046234") or ("8926556") or ("7255681") or ("7008400") or ("6257847") or ("20100145264") or ("20170151380") or ("20070078383") or ("5542921") or ("20180333523") or ("8075516") or ("20180369464") or ("20110071466")).PN.					
L141	111	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-2012004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2019/01/08 01:02 PM

		US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or					

		US-20180333523-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L142	35	L142 and (heavy weight "center of gravity" "centre of gravity" mass)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:03 PM
L143	3497	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:22 PM
L144	284	L144 and (heavy weight "center of gravity" "centre of gravity")	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:22 PM
L145	3497	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 04:06 PM
L146	18	L146 and (weight with distribut$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2019/01/08 04:06 PM

			JPO)				
L147	1	("4535627").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/03/14 02:19 PM
L148	112	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2019/04/16 03:00 PM

		(US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					

L149	21	L149 and (pump$4 with (lightweight mass weight heavy))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 03:00 PM
L150	94	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (weight lightweight))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 03:14 PM
L151	47	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (mass heavy))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 05:04 PM
L152	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (mass heavy)) not L151	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 05:04 PM
L153	1	("20110274566").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/04/19 01:51 PM
L154	1	("20110274566").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/09 12:52 PM
L155	57	(breast with pump) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:04 AM
L156	1	(16/009547).APP.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/15 09:08 AM
L157	1	L157 and (pressure same noise)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:08 AM
L158	635	((piezo piezoelectric) with pump) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:10 AM
L159	1	L157 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:16 AM
L160	26	(breast with pump) and (mmhg and noise)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:24 AM
L161	1	L157 and (liter litre)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:30 AM
L162	1	((piezo piezoelectric) with pump) and "YIP Ventus"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:33 AM
L163	19	(("7550034") or ("8123502") or ("8297947") or ("8371829") or ("8409160") or ("8646479") or ("8734131") or ("8763633") or	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/15 09:36 AM

		("8821134") or ("9051931") or ("9127665") or ("9234518") or ("9239059") or ("9279421") or ("9334858") or ("9506463") or ("9752565") or ("9709042") or ("9777851")).PN.					
L164	5	L164 and (mmhg mbar kpa)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:36 AM
L165	0	L164 and (litre liter)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L166	2	L164 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L167	17	L164 and (piezo piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L168	1	L164 and (piezo piezoelectric) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:38 AM
L169	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:50 AM
L170	1	L170 and gravity	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:50 AM
L171	1	L170 and (gravity same nipple)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:51 AM
L172	61	(breast with pump$4) and ((centre center) with container)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:55 AM
L173	1	L170 and (gravity same container)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:55 AM
L174	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 11:54 AM
L175	1	L176 and (high height)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 11:54 AM
L176	25	(breast with pump$4) and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 12:55 PM
L177	113	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2020/01/09 03:02 PM

		US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or					

		US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$ or US-20180361040-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L178	30	L179 and noise	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 03:02 PM
L179	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2020/01/13 01:45 PM

			JPO)				
L180	1	L181 and gravity	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:45 PM
L181	1	L181 and length	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:46 PM
L182	1	L181 and height	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:48 PM
L183	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:29 PM
L184	1	L185 and "half-way"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:29 PM
L185	113	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2020/01/14 02:36 PM

		20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$ or US-20180361040-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or					

		WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L186	3	L187 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:37 PM
L187	2	L187 and (top with heavy)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:37 PM
L188	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:06 AM
L189	1	L190 and (weight mass)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:06 AM
L190	1	L190 and (housing same battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:07 AM
L191	1	L190 and (shield same (mold$4 mould$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:08 AM
L192	1	L190 and (diaphragm same seal$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:09 AM
L193	0	L190 and (diaphragm same tunnel same flange)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L194	0	L190 and (diaphragm same spaced)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L195	0	L190 and (diaphragm same surround)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L196	1	verhoef.inv. and dog and figure	(US-PGPUB)	OR	OFF	OFF	2020/01/15 01:27 PM
L197	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:28 PM
L198	1	L199 and (shield with single)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:28 PM

L199	67	(a61m$/$).cpc. and (wear$4 with pump$4) and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L200	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L201	1	L202 and (shield with single)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L202	1	L202 and (shield with piece)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:33 PM
L203	0	L202 and ((housing diagraphm) with spac$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:18 PM
L204	1	L202 and (shield with housing with diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:19 PM
L205	1	L202 and ((housing diaphragm) with spac$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:19 PM
L206	143	(breast with pump) and (piezo piezoelectric) and (membrane diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 11:42 AM
L207	78	("20030191433" | "20040024351" | "20040101414" | "20050059928" | "20050131332" | "20050234370" | "20060106334" | "20080045888" | "20080177224" | "20080243059" | "20090024080" | "20100010682" | "20100106082" | "20100217148" | "20110071466" | "20110196291" | "20110245763" | "20110270162" | "20120101575" | "20120277728" | "20130023821" | "20130123688" | "20130131588" | "20130177455" | "20140066734" | "20140378895" | "20140378946" | "20150065994" | "20150100016" |	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2020/09/28 12:42 PM

		"20150148709" | "20150196247" | "20150292500" | "20160015876" | "20160256618" | "20160287769" | "20170072118" | "20170080134" | "20170173232" | "4263912" | "4311141" | "4768547" | "4821580" | "5542921" | "5634468" | "5658133" | "5810772" | "5827191" | "6273868" | "6287252" | "6328082" | "6440100" | "6547756" | "6579258" | "6712785" | "6840918" | "7201735" | "7223255" | "7621797" | "7824363" | "7972297" | "7988661" | "8057425" | "8070715" | "8070716" | "8262606" | "8282596" | "8353865" | "8357116" | "8376986" | "8671701" | "8684961" | "8801495" | "9050404" | "9162016" | "9173587" | "9199017" | "9278167" | "D459233").PN. OR ("10625005").URPN.					
L208	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 02:57 PM
L209	1	L210 and 19a	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 02:57 PM
L210	132289	"201" and recess	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:02 PM
L211	0	L210 and recess	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:02 PM
L212	645454	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:06 PM
L213	574	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:06 PM
L214	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/29 09:51 AM
L215	1	L216 and flat	(US-PGPUB; USPAT;	OR	OFF	OFF	2020/09/29

			USOCR; FPRS; EPO; JPO)				09:51 AM
L216	57377	breast.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L217	398558	pump$4.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L218	92405	(piezo piezoelectric).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L219	72010	diaphragm.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L220	26553	(db decibal).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L221	27368	(db decibal).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L222	2	L218 and L219 and L220 and L221	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L223	2	L218 and L219 and L220 and L224	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L226	32	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((usb "universal serial bus") WITH (charg$4 recharg$4 power$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 12:16 PM
L227	0	214 AND (usb SAME socket)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:25 PM
L228	2	214 AND socket	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:25 PM
L229	2	"61007742".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; JPO)	OR	ON	ON	2021/05/18 12:34 PM

L230	7	"2015069095".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:38 PM
L231	122	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/18 01:00 PM

		20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1					

		OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L232	18	231 AND recharg$5	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:00 PM
L233	2	214 AND (rigid SAME	(US-PGPUB; USPAT;	OR	ON	ON	2021/05/18

		shield)	USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				01:05 PM
L234	27173	a61m5/14244,14248.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:42 PM
L235	555	234 AND ((power$4 batter$4) WITH (charg$5 recharg$5) WITH (usb "universal serial bus"))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:42 PM
L236	82	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND bra AND wireless$4 AND (control$4 processor electronic$4) AND (power$4 battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 01:53 PM
L237	82	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND bra AND wireless$4 AND (control$4 processor electronic$4) AND (power$4 batter$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 01:53 PM
L238	14	231 AND ((charg$5 recharg$5) WITH (power$4 batter$4)) AND wireless$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 03:59 PM
L239	2	"20140275857".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 04:48 PM
L240	12	231 AND (rigid WITH (bottle container))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/05/18 04:52 PM

			AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L241	2	214 AND (shield WITH (flexible silicon$4 material soft rubber))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 05:35 PM
L242	2	231 AND (rigid WITH shield)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 05:38 PM
L243	128	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/20 03:05 PM

		US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-					

		A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-2016058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-					

		2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L244	8	243 AND ((membrane diaphragm) SAME shield)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/20 03:06 PM
L245	88	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH rigid)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:09 PM
L246	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH (plastic rigid) WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:13 PM
L247	7	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:13 PM
L248	68	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (rigid WITH polypropylene)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:14 PM
L249	25	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container) WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:17 PM
L250	19	243 AND ((bottle container) WITH (rigid polypropylene plastic))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:23 PM
L251	21	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container) WITH magnet$6)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:49 PM
L252	2	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:57 PM

		((shield nipple flange) WITH guide WITH line)					
L253	207	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield nipple flange) WITH line)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:57 PM
L254	5	"6328709".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/20 05:59 PM
L255	91	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (nipple WITH line)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 06:00 PM
L256	130	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/21 12:39 PM

		20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1					

		OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-					

		2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L257	1	256 AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 12:39 PM
L258	6	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:40 PM
L259	6	(breast WITH pump$4) AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:41 PM
L260	73	(breast WITH pump$4) AND ((bottle container milk) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:41 PM
L261	11	(breast WITH pump$4) AND ((bottle container milk bag) WITH (polycarbonate tritan)) AND ((bottle container milk storage bag) WITH (clear transparent "see through" see-through))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:45 PM
L262	55	(breast WITH pump$4) AND ((bottle container milk bag) WITH (magnet$6))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 01:09 PM
L263	182	(breast WITH pump$4) AND ((shield flange) WITH (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 01:26 PM
L264	132	((US-6440100-B1 OR US-6547756-B1 OR	(USPAT; US-PGPUB; FPRS; USOCR;	OR	ON	ON	2021/05/21 01:26 PM

		US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1	IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))				

		OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-					

		20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L265	9	264 AND (clear transparent) WITH (container bottle bag)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/05/21 01:27 PM

			IBM_TDB)				
L266	4	264 AND (polycarbonate) WITH (container bottle bag)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 01:27 PM
L267	6	(breast WITH pump$4) AND ((bottle container milk) WITH (polycarbonate tritan)) AND ((bottle container milk) WITH dishwash$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 02:28 PM
L268	34	264 AND ((alert$4 indicat$4 light) WITH (milk))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 03:46 PM
L269	19	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH start$4 WITH stop$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:36 PM
L270	21	264 AND (milk WITH (indicat$4 alert$4 display$4) WITH (flow$4 volume))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:39 PM
L271	20	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH threshold)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:55 PM
L272	95	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH (predetermin$4 limit level))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:58 PM
L273	38	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH (predetermin$4 limit level) WITH (increas$4 decreas$4 chang$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:58 PM
L274	4	(a61m1/062 a61m1/066	(US-PGPUB; USPAT;	OR	OFF	OFF	2021/05/21

		a61m1/06 a41c4/04 a61j13/00).cpc. AND (pump$4 WITH alert$4 WITH (correct$4))	USOCR; FPRS; EPO; JPO)				05:00 PM
L275	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (operat$4 WITH alert$4 WITH (correct$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:00 PM
L276	9	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (alert$4 WITH (correct$4 proper$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:00 PM
L277	23	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH rotat$4 WITH position$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:44 PM
L278	62	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH slid$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:03 PM
L279	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH slid$4 WITH (attach$4 coupl$4 connect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:04 PM
L280	71	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH thread$4 WITH (attach$4 coupl$4 connect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:06 PM
L281	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((clean$4 disinfect$4 sanitiz$4) WITH (shield flange) WITH (container bottle bag))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:20 PM
L282	111	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (diaphragm WITH (housing holder))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:44 PM
L283	2	"20120277728".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/05/21 06:46 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L284	7	264 AND (light WITH emit$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 06:55 PM
L285	11	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (db decibel)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:12 PM
L286	77	(breast WITH pump$4) AND (db decibel)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:17 PM
L287	75	willow AND (breast WITH pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:26 PM
L288	20047	(a61m a61b).cpcl. AND (pump$ wth piezo piezoelectric) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L289	9898	(a61m a61b).cpcl. AND (pump$ WITH piezo piezoelectric) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L290	892	(a61m a61b).cpcl. AND (pump$ WITH piezo piezoelectric) SAME (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L291	892	(a61m a61b).cpcl. AND (pump$4 WITH piezo piezoelectric) SAME (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L292	24	(a61m a61b).cpcl. AND (pump$4 WITH (piezo	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/05/21 07:33 PM

		piezoelectric)) SAME (decibel db)	AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L293	654	(a61m a61b).cpcl. AND (pump$4 WITH (piezo piezoelectric)) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:34 PM
L294	337	(a61m a61b).cpcl. AND (pump$4 WITH (piezo piezoelectric)) AND (decibel db)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/05/21 07:34 PM
L295	138	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/22 09:07 AM

		US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-					

		A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-					

		2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L296	13	295 AND (bar mbar kpa) AND "flow rate"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 09:07 AM
L297	2	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (pressure WITH kpa mmhg mbar bar) AND ((air vacuum$4 suction$4) WITH l/min)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/22 09:21 AM
L298	157	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (pressure WITH (kpa mmhg mbar bar))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/22 09:23 AM
L299	2	16/009547.app. AND (mechanism SAME container SAME housing)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L300	2	16/009547.app. AND (mechanism WITH container WITH housing)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/05/22 10:47 AM

			JPO; DERWENT; IBM_TDB)				
L301	40	295 AND magnet$6	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:50 AM
L302	6	295 AND (magnet$6 WITH (container bag bottle))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:51 AM
L303	599	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/24 12:04 PM
L304	7	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/24 02:33 PM
L305	140	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/02 03:38 PM

		OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-					

		20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1					

		OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L306	2	140 AND piezo	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:38 PM
L307	14	140 AND piezo$8	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:38 PM
L308	32	305 AND piezo$8	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/06/02 03:39 PM

			JPO; DERWENT; IBM_TDB)				
L309	6	305 AND piezo$8 AND parallel	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:41 PM
L310	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((container milk bottle) WITH (angle tilt$4) WITH (sens$4 detect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:47 PM
L311	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH right WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:54 PM
L312	78	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (which WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L313	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L314	10	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH sens$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L315	11	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH select$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:59 PM
L316	33	305 AND (maximum WITH (suction$4 vacuum$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 04:02 PM
L317	16	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((icon button) WITH start$4 WITH (stop$4	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:06 PM

		paus$4))					
L318	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH tritan)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:08 PM
L319	3	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH (transparent clear)) AND ((shield flange) WITH polycarbonate)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:08 PM
L321	195	((milk lactat$4 breast) WITH pump$4) AND ((shield flange) WITH magnet$6)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/14 01:25 PM
L322	4	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH (transparent clear)) AND ((shield flange) WITH (tritan polycarbonate))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/15 12:15 PM
L323	250	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) SAME (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/15 01:51 PM
L324	19	("7550034," "8123502," "8297947," "8371829," "8409160," "8646479," "8734131," "8763633," "8821134," "9051931," "9127665," "9234518," "9239059," "9279421," "9334858," "9506463," "9752565," "9709042," "9777851").pn.	(USPAT)	OR	ON	ON	2021/06/16 12:28 PM
L325	9	324 AND stall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 12:28 PM
L326	19	"stall pressure" WITH (aspirat$4 vacuum$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/06/16 12:35 PM

		suction$4)	AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L327	4184	(stall WITH pressure WITH pump$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 12:39 PM
L328	3	324 AND mbar	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 01:42 PM
L329	50	(ttp WITH ventus)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 01:54 PM
L330	3	(ttp WITH ventus)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/06/16 01:54 PM
L331	252	(ventus)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/06/16 01:55 PM
L332	36	((stall WITH pressure WITH pump$4) SAME piezo$10)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 02:28 PM
L333	18	324 AND maximum	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 02:35 PM
L334	52	pump$4 WITH stall WITH piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/06/16 02:38 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L335	220	(breast SAME pump$4 SAME piezo$10)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 03:17 PM
L336	79	(breast WITH pump$4) AND (pressure WITH (stall$4 crack$4 occlusion break$4 block$4) WITH (mmhg kpa mbar bar pa))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 03:35 PM
L337	68	ventus AND piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:11 PM
L338	11	337 AND stall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:12 PM
L339	11	337 AND (mmhg mbar kpa)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:13 PM
L340	0	324 AND l/min	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:43 PM
L341	11	324 AND (air WITH flow$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/06/19 03:43 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L342	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/19 03:48 PM

		A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR					

		US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR					

		WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L343	1	342 AND "l/min"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:49 PM
L344	6	324 AND (free WITH flow)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:49 PM
L345	2	("10881766").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 06:28 PM
L346	2	("10926011").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD,	OR	ON	ON	2021/06/19 06:44 PM

			DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L347	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/19 09:14 PM

		US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-					

		A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR					

		CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L348	39	347 AND piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:14 PM
L349	28	347 AND piezo$10 AND breast	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:14 PM
L350	2	"10881766".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:39 PM
L351	3	("9,585,998").pn.	(US-PGPUB; USPAT;	OR	ON	ON	2021/06/21

			USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				09:14 AM
L352	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/07/14 04:33 PM

		A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR					

		US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-					

		2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L353	8341	a61m1/06-066.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/13 09:11 AM
L354	147	353 AND ((shield flange) WITH rib)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/13 09:12 AM
L355	5	("5875976").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/10/13 11:12 AM

			IBM_TDB)				

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	17203050
	Filing Date	2021-03-16
	First Named Inventor	Jonathan O'Toole
	Art Unit	3783
	Examiner Name	C. Fredrickson
	Attorney Docket Number	373499.00050

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5542921	A	1996-08-06	MEYERS, et al.	
	2	7833190	B1	2010-11-16	HALL	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20070135761	A1	2007-06-14	CHENG, et al.	
	2	20170112983	A1	2017-04-27	THORNE, et al.	
	3	20180333523	A1	2018-11-22	CHANG, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17203050
	Filing Date	2021-03-16
	First Named Inventor	Jonathan O'Toole
	Art Unit	3783
	Examiner Name	C. Fredrickson
	Attorney Docket Number	373499.00050

	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/COURTNEY B FREDRICKSON/	Date Considered	10/25/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17203050
	Filing Date	2021-03-16
	First Named Inventor	Jonathan O'Toole
	Art Unit	3783
	Examiner Name	C. Fredrickson
	Attorney Docket Number	373499.00050

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

✓ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

✓ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark D. Simpson/	Date (YYYY-MM-DD)	2021-09-05
Name/Print	Mark D. Simpson	Registration Number	32942

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.B.F./

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 17/203,050	Filing Date 03/16/2021	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)			
FOR	NUMBER FILED	NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $240 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	02/04/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 28	Minus	** 30	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/POLIN ANG/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Docket No.: ELVI-002/07US 339454-2026
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Jonathan O'TOOLE	Confirmation No.:	9649
Application No.:	17/203,050	Group Art Unit:	3783
Filed:	March 16, 2021	Examiner:	FREDRICKSON, COURTNEY B

For: BREAST PUMP SYSTEM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT/RESPONSE TO FINAL OFFICE ACTION

In response to the final Office Action dated November 4, 2021, to which the deadline for responding is February 4, 2022, Applicant submits the following Amendments and/or Remarks, and respectfully requests reconsideration of the application in view thereof.

Any extensions of time necessary to prevent abandonment of this application are hereby petitioned for under 37 C.F.R. §1.136(a), and any additional fees required (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 50-1283.

Amendments to the Claims are reflected in the listing of the claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

IN THE CLAIMS:

Set forth below in ascending order, with status identifiers, is a complete listing of all claims currently under examination. Changes to any amended claims are indicated by [[double brackets]], ~~strikethrough~~ and/or underlining. This listing also reflects any cancellation and/or addition of claims.

1. (Previously Presented) A breast pump device that is configured as a self-contained, in-bra wearable device, the breast pump device comprising:

(i) a housing that includes (a) a battery, and (b) a pump powered by the battery and generating negative air pressure;

(ii) a breast shield made up of a breast flange and a nipple tunnel;

(iii) a milk container that is configured to be attached to and removed from the housing; and

(iv) a diaphragm configured to be seated against a diaphragm holder that forms a recess or cavity at least in part with an external surface of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel.

2. (Previously Presented) The breast pump device of Claim 1, in which the pump comprises a piezo air pump system.

3. (Previously Presented) The breast pump device of Claim 1, in which the pump is positioned at or close to a base of the housing.

4. (Currently Amended) The breast pump device of Claim 1, in which ~~the pump delivers in excess of 400 mBar (40 kPa) stall pressure and 1.5 litres per minute free air flow and is a lightweight air pump that enables~~ a total mass of the breast pump device, unfilled with milk, is ~~to be~~ less than 250 gm.

5. (Previously Presented) The breast pump device of Claim 1, in which the breast pump device makes less than 30 dB noise at maximum power and less than 25 dB at normal power, against a 20 dB ambient noise.

6. (Original) The breast pump device of Claim 1, in which the breast shield is substantially rigid.

7. (Previously Presented) The breast pump device of Claim 1, in which the breast shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto a breast.

8. (Previously Presented) The breast pump device of Claim 1, in which the breast shield is a one piece item that, in use, presents a single continuous surface to a nipple and a breast.

9. (Original) The breast pump device of Claim 1, in which the breast shield integrates the breast flange and nipple tunnel as a one-piece item.

10. (Original) The breast pump device of Claim 1, in which the breast flange and the nipple tunnel are a single, integral item with no joining stubs.

11. (Previously Presented) The breast pump device of Claim 1, in which the breast shield is generally symmetrical about a centre-line running from a top to a bottom of the breast shield when positioned upright for normal use.

12. (Canceled)

13. (Original) The breast pump device of Claim 1, in which the housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.

14. (Previously Presented) The breast pump device of Claim 1, in which the breast pump device includes only the breast shield and the milk container ~~two parts~~ that are directly removable from the housing in normal use or normal dis-assembly.

15. (Previously Presented) The breast pump device of Claim 1, in which the diaphragm is a flexible membrane.

16. (Original) The breast pump device of Claim 1, in which the diaphragm is substantially circular and is configured to self-seal under the negative air pressure to a substantially circular diaphragm holder that is part of the housing.

17. (Canceled)

18. (Canceled)

19. (Original) The breast pump device of Claim 1, in which the milk container is substantially rigid.

20. (Previously Presented) The breast pump device of Claim 1, in which the milk container is configured to attach to a lower part of the housing and to form a flat bottomed base for the breast pump device.

21. (Previously Presented) The breast pump device of Claim 1, in which the milk container has a surface shaped to continue a curved shape of the housing, so that the breast pump device can be held comfortably inside the bra.

22. (Original) The breast pump device of Claim 1, in which the milk container includes a flexible valve that self-seals under negative air pressure against a milk opening in the nipple tunnel and that permits milk to flow into the milk container.

23. (Previously Presented) The breast pump device of Claim 1, in which the milk container is attachable to the housing with a mechanical or magnetic mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.

24. (Original) The breast pump device of Claim 1, in which the milk container includes a cap that is removable from the milk container and a removable valve that enables milk to pass into the milk container in one direction.

25. (Previously Presented) The breast pump device of Claim 1, in which a top of the milk container includes an optically clear region that is aligned below one or more light emitters positioned in a base of the housing.

26. (Previously Presented) The breast pump device of Claim 1, in which the milk container is wider than the milk container is tall.

27. (Previously Presented) The breast pump device of Claim 1, in which the housing includes a wireless data communications system powered by the battery.

28. (Original) The breast pump device of Claim 1, in which the housing has a front surface that is configured to fit inside a bra and to contact an inner surface of the bra, and a rear surface that is shaped to contact, at least in part, the breast shield.

29. (Previously Presented) The breast pump device of Claim 1, in which the housing includes at least one of a visual or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

30. (Previously Presented) The breast pump device of Claim 1, in which the housing includes at least one of a visual or haptic indicator that indicates if the pump is operating correctly to pump milk, based on whether a quantity or a height of liquid in the milk container above a base of the milk container is increasing above a threshold rate of increase.

31. (Canceled)

32. (New) The breast pump device of Claim 1, wherein the battery is a rechargeable battery, and the housing further includes: (c) a power charging circuit for controlling the charging of the rechargeable battery, and (d) control electronics powered by the rechargeable battery.

REMARKS

Upon entry to these amendments, claims 1-11, 13-16, 19-30, and 32 are pending in the present application. In this response, claims 17, 18, and 31 have been cancelled, without prejudice or disclaimer, and new claim 32 has been added. Support for the claim amendments can be found throughout the application as originally filed. No new matter is added. Based on the above Amendments and the following Remarks, Applicant respectfully requests that the Examiner reconsider and withdraw all outstanding rejections.

Allowable Subject Matter

Applicant appreciates the Examiner's indication that previously presented claims 1-11, 13-16, and 19-30 are allowed.

Claim Rejections – 35 U.S.C. § 112(b)

Claim 18 stands rejected under 35 U.S.C. 112(b), as being indefinite. In response, Applicant has canceled claim 18 and therefore submits that this rejection is now moot.

Claim Rejections – 35 U.S.C. § 103

Claim 31 stands rejected under 35 U.S.C. 103, as allegedly being unpatentable over Khalil (US 20130023821) in view of Makower (US 20170072118). Applicant has canceled claim 31 and therefore submits that this rejection is now moot.

Double Patenting

Claim 17 stands rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 1 of U.S. Patent No. 10,881,766. Claim 17 stands rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 32 of U.S. Patent No. 10,926,011. Claim 17 stands provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 37 of copending Application No. 17/203,109. Claim 17 stands provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 13 of copending Application No. 17/203,150. Claim 17 stands provisionally rejected on the ground of nonstatutory double

patenting as allegedly being unpatentable over claim 13 of copending Application No. 17/203,313. Claim 17 stands provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 13 of copending Application No. 17/203,355. Claim 17 stands provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 13 of copending Application No. 17/203,397. Claim 17 stands provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 13 of copending Application No. 17/203,418. Claim 31 stands provisionally rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claim 1 of copending Application No. 17/181,057, 17/203,079, 17/203,179, 17/203,216, 17/203,259, 17/203,292, 17/203,313, 17/203,327, 17/203,355, 17/203,384, 17/203,397, 17/203,418.

Applicant has canceled claim 17 and therefore submits that these rejections are now moot.

New Claim 32

New claim 32 depends from independent claim 1, which has been allowed. Therefore, Applicant respectfully submits that new claim 32 is allowable at least due to its dependency from independent claim 1.

CONCLUSION

In view of the foregoing, Applicant respectfully submits that no further impediments exist to the allowance of this application and, therefore, requests an indication of allowability. However, the Examiner is requested to call the undersigned if any questions or comments arise.

The Director is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-1283 referencing Docket No. ELVI-002/07US 339454-2026.

Dated: February 4, 2022

Respectfully submitted,
COOLEY LLP

By: /Kassity L. Mai/
Kassity L. Mai
Reg. No. 68,774
C. Scott Talbot
Reg. No. 34,262

USPTO CUSTOMER NO. 58249

COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue NW, Suite 700
Washington, DC 20004

Tel: (202) 842-7853
Fax: (202) 842-7899

Electronic Acknowledgement Receipt

EFS ID:	44920771
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	58249
Filer:	Kassity L. Mai/Julie Chandler
Filer Authorized By:	Kassity L. Mai
Attorney Docket Number:	ELVI-002/07US
Receipt Date:	04-FEB-2022
Filing Date:	16-MAR-2021
Time Stamp:	15:44:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		ELVI_002_07US_Response_to_OA.pdf	207059 34e5d451cdd483e61fdc79bb9fa2a6f698f3584f	yes	8

Multipart Description/PDF files in .zip description

Document Description	Start	End
Response After Final Action	1	1
Claims	2	5
Applicant Arguments/Remarks Made in an Amendment	6	8

Warnings:

Information:

Total Files Size (in bytes):	207059

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	17/203,050
Filing Date	03/16/2021
First Named Inventor	Jonathan O'TOOLE
Title	BREAST PUMP SYSTEM
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	4944.0120007

SIGNATURE of Applicant or Patent Practitioner

Signature	/Anupma Sahay #78,704/	Date (Optional)	
Name	Anupma Sahay	Registration Number	78,704
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)	Chiaro Technology Limited		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 26111

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

CHIARO TECHNOLOGY LIMITED

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/Hannah Brunskill/	Date (Optional)	8 December 2021
Name	Hannah Brunskill		
Title	Head of Legal		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

Electronic Acknowledgement Receipt

EFS ID:	44978171
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	58249
Filer:	Anupma Sahay/Rolonda Lee
Filer Authorized By:	Anupma Sahay
Attorney Docket Number:	ELVI-002/07US
Receipt Date:	11-FEB-2022
Filing Date:	16-MAR-2021
Time Stamp:	18:09:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	2022-02-11-Transmittal-Form-4944-0120007.pdf	1288061 b2140b23400aa680e326e8e73fec9c9afb002472	no	2

Warnings:

Information:

2	Authorization for Extension of Time all replies	2022-02-11-EOT-Authorization-4944-0120007.pdf	97938 64f5f9eea020a1c803e52224ef2eb6c99debb40e	no	1
Warnings:					
Information:					
3	Power of Attorney	2022-02-11-POA-82A-4944-0120007.pdf	516062 49767deb418a3350f03839910b31da3f71808d09	no	1
Warnings:					
Information:					
4	Power of Attorney	2022-02-11-POA-82B-4944-0120007.pdf	511115 5e451e3a83d380b0a0fd9f4fe4a91f242d909fe7	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	2413176		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	17/203,050
Filing Date	03/16/2021
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	Courtney B. FREDRICKSON
Attorney Docket Number	4944.0120007
Total Number of Pages in This Submission	

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☑ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) ______
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☑ Other Enclosure(s) (please Identify below):

Authorization under 37 CFR 1.136(a)(3)

Remarks

The Office may charge any fee deficiency for any submission made with this transmittal to Deposit Account 19-0036.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Sterne, Kessler, Goldstein & Fox P.L.L.C.		
Signature	/Anupma Sahay #78,704/		
Printed name	Anupma Sahay		
Date	February 11, 2022	Reg. No.	78,704

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name		Date	

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: Jonathan O'TOOLE	Confirmation No.: 9649
Applicant: Chiaro Technology Limited	Art Unit: 3783
Application No.: 17/203,050	Examiner: Courtney B. FREDRICKSON
Filing Date: 03/16/2021	Atty. Docket: 4944.0120007

Title: **BREAST PUMP SYSTEM**

Authorization to Treat a Reply as Incorporating an Extension of Time Under 37 C.F.R. § 1.136(a)(3)

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Commissioner:

The U.S. Patent and Trademark Office is hereby authorized to treat any concurrent or future reply that requires a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. The U.S. Patent and Trademark Office is hereby authorized to charge all required extension of time fees to our Deposit Account No. 19-0036, if such fees are not otherwise provided for in such reply.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Anupma Sahay #78,704/

Anupma Sahay
Attorney for Applicant
Registration No. 78,704

Date: February 11, 2022

1100 New York Avenue, N.W.
Washington, D.C. 20005-3934
(202) 371-2600

18011811_1

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US

CONFIRMATION NO. 9649

POWER OF ATTORNEY NOTICE

OC000000131861531

58249
COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue, NW
Suite 700
Washington, DC 20004

Date Mailed: 02/17/2022

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/11/2022.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ngfissha/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US

CONFIRMATION NO. 9649

POA ACCEPTANCE LETTER

OC000000131861569

26111
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

Date Mailed: 02/17/2022

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/11/2022.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ngfissha/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

26111 7590 02/23/2022
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
FREDRICKSON, COURTNEY B	
ART UNIT	PAPER NUMBER
3783	

DATE MAILED: 02/23/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US	9649

TITLE OF INVENTION: BREAST PUMP SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	05/23/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26111 7590 02/23/2022
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US	9649

TITLE OF INVENTION: BREAST PUMP SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	05/23/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
FREDRICKSON, COURTNEY B	3783	604-067000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ____________________

2 ____________________

3 ____________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies ____________

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. __________

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ______________________ Date ______________________

Typed or printed name ______________________ Registration No. ______________________

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US	9649

26111 7590 02/23/2022
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
FREDRICKSON, COURTNEY B	
ART UNIT	**PAPER NUMBER**
3783	

DATE MAILED: 02/23/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 17/203,050	**Applicant(s)** O'TOOLE et al.	
	Examiner COURTNEY FREDRICKSON	**Art Unit** 3783	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.☑ This communication is responsive to the after-final amendment filed on 2/4/2022.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ______.

2.☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ______; the restriction requirement and election have been incorporated into this action.

3.☑ The allowed claim(s) is/are See Continuation Sheet . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4.☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☑All b) ☐ Some* c) ☐ None of the:

1. ☑ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ______ .
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ______ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5.☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ______ .

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6.☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1.☐ Notice of References Cited (PTO-892)
2.☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date ______.
3.☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material ______.
4.☐ Interview Summary (PTO-413), Paper No./Mail Date. ______.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other ______.

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783	/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783

Continuation of 3. The allowed claim(s) is/are: 1-11,13-16,19-30 and 32

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Allowable Subject Matter

Claims 1-11, 13-16, 19-30, and 32 are allowed over the prior art of record.

The following is an examiner's statement of reasons for allowance: The claims in this application are allowed because the prior art of record fails to disclose either singly or in combination the claimed breast pump device.

See Reasons for Allowance provided in Final Rejection mailed on 11/4/2021.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY FREDRICKSON whose telephone number is (571)270-7481. The examiner can normally be reached Monday-Friday (9 AM - 5 PM EST).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, NATHAN PRICE can be reached on 571-270-5421. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY B FREDRICKSON/
Examiner, Art Unit 3783

/NATHAN R PRICE/
Supervisory Patent Examiner, Art Unit 3783

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/203,050	O'TOOLE et al.
	Examiner	Art Unit
	COURTNEY FREDRICKSON	3783

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE									
Final	Original	06/12/2021	10/25/2021	02/10/2022							
	1	✓	=	=							
	2	✓	=	=							
	3	✓	=	=							
	4	✓	=	=							
	5	✓	=	=							
	6	✓	=	=							
	7	✓	=	=							
	8	✓	=	=							
	9	✓	=	=							
	10	✓	=	=							
	11	✓	=	=							
	12	✓	-	-							
	13	✓	=	=							
	14	✓	=	=							
	15	✓	=	=							
	16	✓	=	=							
	17	✓	✓	-							
	18	✓	✓	-							
	19	✓	=	=							
	20	✓	=	=							
	21	✓	=	=							
	22	✓	=	=							
	23	✓	=	=							
	24	✓	=	=							
	25	✓	=	=							
	26	✓	=	=							
	27	✓	=	=							
	28	✓	=	=							
	29	✓	=	=							
	30	✓	=	=							
	31		✓	-							
	32			=							

Search Notes	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.
	Examiner COURTNEY FREDRICKSON	Art Unit 3783

CPC - Searched*		
Symbol	Date	Examiner
a61m1/06, 1/062, 1/066; a61j13/00; a41c4/04	06/19/2021	cbf

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
see SEARCH history	06/19/2021	cbf
searched inventors in SEARCH and PALM	06/19/2021	cbf
Consulted parent history	06/19/2021	cbf
Updated search	10/25/2021	cbf

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	see SEARCH history	02/10/2022	cbf

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/203,050	O'TOOLE et al.
	Examiner	**Art Unit**
	COURTNEY FREDRICKSON	3783

CPC							
Symbol						**Type**	**Version**
A61M	/	1	/	062		F	2014-02-04
A61M	/	1	/	066		I	2013-01-01
G16H	/	40	/	63		I	2018-01-01
A61M	/	1	/	06		I	2013-01-01
A41C	/	3	/	04		A	2013-01-01
A61J	/	9	/	00		A	2013-01-01
A61M	/	39	/	223		A	2013-01-01
A61M	/	39	/	24		A	2013-01-01
A61M	/	2205	/	07		A	2013-01-01
A61M	/	2205	/	10		A	2013-01-01
A61M	/	2205	/	3313		A	2013-01-01
A61M	/	2205	/	3327		A	2013-01-01
A61M	/	2205	/	3334		A	2013-01-01
A61M	/	2205	/	3344		A	2013-01-01
A61M	/	2205	/	3389		A	2013-01-01
A61M	/	2205	/	3553		A	2013-01-01
A61M	/	2205	/	3584		A	2013-01-01
A61M	/	2205	/	3606		A	2013-01-01
A61M	/	2205	/	502		A	2013-01-01
A61M	/	2205	/	505		A	2013-01-01
A61M	/	2205	/	52		A	2013-01-01
A61M	/	2205	/	581		A	2013-01-01
A61M	/	2205	/	582		A	2013-01-01
A61M	/	2205	/	583		A	2013-01-01
A61M	/	2205	/	584		A	2013-01-01
A61M	/	2205	/	587		A	2013-01-01
A61M	/	2205	/	6054		A	2013-01-01
A61M	/	2205	/	702		A	2013-01-01
A61M	/	2205	/	7536		A	2013-01-01
A61M	/	2205	/	80		A	2013-01-01
A61M	/	2205	/	8206		A	2013-01-01

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783 (Assistant Examiner)	10 February 2022 (Date)	**Total Claims Allowed:** 28	
/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783 (Primary Examiner)	11 February 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

U.S. Patent and Trademark Office Part of Paper No.: 202202104

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/203,050	O'TOOLE et al.
	Examiner	**Art Unit**
	COURTNEY FREDRICKSON	3783

CPC						
Symbol					**Type**	**Version**
A61M	/	2209	/	082	A	2013-01-01
A61M	/	2209	/	088	A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783 (Assistant Examiner)	10 February 2022 (Date)	**Total Claims Allowed:** 28
/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783 (Primary Examiner)	11 February 2022 (Date)	O.G. Print Claim(s): 1 / O.G. Print Figure: 1

U.S. Patent and Trademark Office Part of Paper No.: 202202104

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/203,050	O'TOOLE et al.
	Examiner	Art Unit
	COURTNEY FREDRICKSON	3783

INTERNATIONAL CLASSIFICATION				
CLAIMED				
A61M	/	1	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783 (Assistant Examiner)	10 February 2022 (Date)	Total Claims Allowed: 28	
/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783 (Primary Examiner)	11 February 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

U.S. Patent and Trademark Office Part of Paper No.: 202202104

Issue Classification	Application/Control No. 17/203,050	Applicant(s)/Patent Under Reexamination O'TOOLE et al.
	Examiner COURTNEY FREDRICKSON	Art Unit 3783

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12		21		30								
	4		13		22		31								
	5		14		23		32								
	6		15		24										
	7		16		25										
	8		17		26										
	9		18		27										

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783 (Assistant Examiner)	10 February 2022 (Date)	Total Claims Allowed: 28	
/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783 (Primary Examiner)	11 February 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Bibliographic Data

Application No: 17/203,050

Foreign Priority claimed: ☒ Yes ☐ No

35 USC 119 (a-d) conditions met: ☒ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /COURTNEY B FREDRICKSON/

Examiner's Signature

Initials

Title: BREAST PUMP SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/16/2021	604	3783	ELVI-002/07US
RULE			

APPLICANTS

CHIARO TECHNOLOGY LIMITED, London, UNITED KINGDOM

INVENTORS

Jonathan O'TOOLE, London, UNITED KINGDOM

Adam ROLLO, London, UNITED KINGDOM

Andrew CARR, London, UNITED KINGDOM

CONTINUING DATA

This application is a CON of 17181057 02/22/2021

17181057 is a CON of 16009547 06/15/2018 PAT 10926011

FOREIGN APPLICATIONS

UNITED KINGDOM GB1709564.7 06/15/2017

UNITED KINGDOM GB1709561.3 06/15/2017

UNITED KINGDOM GB1709566.2 06/15/2017

UNITED KINGDOM GB1809036.5 06/01/2018

IF REQUIRED, FOREIGN LICENSE GRANTED**

03/24/2021

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED KINGDOM

ADDRESS

COOLEY LLP
ATTN: IP Docketing Department
1299 Pennsylvania Avenue, NW
Suite 700

Washington, DC 20004
UNITED STATES

FILING FEE RECEIVED

$3,710

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	268	a61m1/$.cpc. AND ((breast milk) WITH pump$4) AND ((power$4 battery) WITH (charg$4 recharg$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/12 04:05 PM
L2	65	("20020193731"|"20040056641"|"20040074281"|"20040267215"|"20050219302"|"20060122575"|"20070051172"|"20070051727"|"20080262420"|"20120277636"|"20140052056"|"20150217036"|"20150217037"|"20150283311"|"20160000980"|"20160058929"|"20160082165"|"20160082166"|"20160151551"|"20160158424"|"20160206794"|"20160220743"|"20160220745"|"20160287767"|"20160296681"|"20160310650"|"20170021068"|"20170035951"|"20170143879"|"20170220753"|"20180021490"|"2849881"|"4390024"|"5474683"|"5941847"|"5973770"|"6045529"|"6090065"|"6383163"|"6440100"|"6461324"|"6547756"|"6579258"|"6663587"|"6749582"|"7048519"|"7201735"|"7312554"|"7314400"|"7776008"|"8057425"|"8118772"|"8187227"|"8262606"|"8282596"|"8376986"|"8702646"|"8801495"|"8876760"|"8926556"|"9033913"|"9173587"|"9345274"|"9539377"|"D548831").PN.	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/07 01:17 PM
L3	214	(jonathan near3 o'toole).inv. (adam near3 rollo).inv. (andrew near3 carr).inv.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 01:42 PM
L4	63	(a61m1/062 a61m1/066 a61m1/06).cpc. and	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2018/08/07 01:45 PM

		piezo$9	JPO)				
L5	19	("20040122358" | "20060226108" | "20080077042" | "20080167579" | "20120004603" | "3895533" | "4024856" | "4338953" | "5347656" | "5666104" | "5827191" | "7316653" | "7621797" | "7794425" | "8308648" | "8777864" | "8801658" | "8827911").PN. OR ("8992445").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/07 01:50 PM
L6	7	("5730139" | "6423010" | "6602199" | "7479154" | "8206414" | "8425426" | "8992445").PN. OR ("9192325").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/07 01:59 PM
L7	582	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:16 PM
L8	3369	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:58 PM
L9	2787	(a61m1/062 a61m1/066 a61m1/06).cpc. not L7	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:58 PM
L10	45	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/07 02:59 PM

		20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$).did. or (WO-2015174330-$ or WO-2016024558-$).did.					
L11	14	L10 and (pump$4 same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/07 02:59 PM
L12	2	"60479361".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/07 03:04 PM
L13	143	a61j13/00.cpc.	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/10 10:30 AM
L14	409	a61j13/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:30 AM
L15	3369	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:43 AM
L16	582	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L17	0	(a61m1/062 a61m1/066 a61m1/06).cpc. not (L16 L15)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L18	2665	(a61m1/062 a61m1/066 a61m1/06).cpc. not (L16 L14)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 10:44 AM
L19	71	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 11:47 AM

		US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$).did.					

L20	37	L19 and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 11:48 AM
L21	4	L19 and ((air with pump$4) same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 11:50 AM
L22	16	L19 and (pump$4 same diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 12:15 PM
L23	1	L19 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/10 12:40 PM
L24	0	a61m1/1058.cpc. and breast and diaphragm	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 12:42 PM
L25	5	breast same pump$4 same piezo$8 same air	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/10 12:43 PM
L26	1	("9884172").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/10 01:58 PM
L27	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:40 AM
L28	2	"59563385".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:20 AM
L29	1	"59563425".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:20 AM
L30	87	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 10:26 AM

		20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$).did.					
L31	44	L30 and (air with	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/24

		pump$4)	USOCR; FPRS; EPO; JPO)				10:26 AM
L32	17	L30 and (pump$4 with diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 10:27 AM
L33	51	L27 and "air pump"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 11:07 AM
L34	4	"47900902".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 11:13 AM
L35	10	("20030212374" | "20050251089" | "20050283900" | "20070135778" | "20110054389" | "3084691" | "4229029" | "5295957" | "6070659").PN. OR ("9511176").URPN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/24 11:16 AM
L36	2	"51149640".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 11:17 AM
L37	271	L27 and (control$4 same select$4 left same right same breast)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 12:50 PM
L38	3	L30 and (recharg$4 with battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 01:04 PM
L39	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:41 PM
L40	9	L39 and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:41 PM
L41	11	L39 and (light with milk with (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:48 PM
L42	0	L39 and (radiation with milk with (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:51 PM
L43	2	L39 and (radiation same milk same (volume quantity amount height))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 02:51 PM
L44	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:13 PM
L45	10	L44 and ((piezo piezoelectric piezo-electric) same air same pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:13 PM
L46	1	a61m1/1058 and	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/24

		(suction$4 vacuum$4 aspirat$4)	USOCR; FPRS; EPO; JPO)				07:23 PM
L47	27	a61m1/1058.cpc. and (suction$4 vacuum$4 aspirat$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:23 PM
L48	23	L44 and (indicator same milk same (express$4 flow$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:26 PM
L49	51	L44 and (air same pressure same sens$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:30 PM
L50	19	L44 and ((indicat$4 record$4) same (right and left))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:38 PM
L51	56	L44 and (pump$4 with series)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:42 PM
L52	77	L44 and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:47 PM
L53	87	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/24 07:59 PM

		20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$).did.					
L54	44	L53 and (air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:59 PM
L55	5	L54 and (air with filter$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 07:59 PM

L56	3	L44 and (pump$4 with (db decibal?))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:07 PM
L57	6	L44 and ((db decibal?))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:07 PM
L58	26	L44 and (sens$4 with (orientation angle tilt placement))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:16 PM
L59	9	L44 and ((indicat$4 input$4 document$4 record$4) with comfort)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:31 PM
L60	484	a61m$/$.cpc. and ((indicat$4 input$4 document$4 record$4) with comfort)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:32 PM
L61	1	L44 and "social media"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/24 08:52 PM
L62	408	a61m$/$.cpc. and ((piezo piezoelectric piezo-electric) same air same pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:13 PM
L63	3606	a61m$/$.cpc. and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:18 PM
L64	359	a61m$/$.cpc. and ((pump$4 with weigh$4) same (portable lightweight carry$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/25 06:30 PM
L65	1	("20160166745").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/25 07:16 PM
L66	1	("20160058928").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/25 07:23 PM
L67	1	("20110004154").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/26 10:55 AM
L68	96	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/26 11:09 AM

		US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-					

		8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L69	2	L69 and (radiation same (height quantity amount volume))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/26 11:09 AM
L70	96	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/26 12:24 PM

		20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-					

		2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L71	3	L71 and ((diaphragm membrane) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/26 12:24 PM
L72	3606	a61m$/$.cpc. and (pump$4 with weigh$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:09 PM
L73	137	L73 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:09 PM
L74	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:10 PM
L75	9	L75 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:10 PM
L76	19	L75 and (shield with snap$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:16 PM
L77	1	("20110152855").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 01:20 PM
L78	32	L75 and (flow with rate with air)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:33 PM
L79	3	L75 and (stall with pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:56 PM
L80	98	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/27 01:56 PM

		US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$).did. or (WO-2015174330-$ or					

		WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$).did.					
L81	17	L81 and (pressure same (mmhg kpa mbar pa bar))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 01:57 PM
L82	18	(("7550034") or ("8123502") or ("8297947") or ("8371829") or ("8409160") or ("8646479") or ("8734131") or ("8763633") or ("8821134") or ("9051931") or ("9127665") or ("9239059") or ("9279421") or ("9334858") or ("9506463") or ("9752565") or ("9709042") or ("9777851")).PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 02:08 PM
L83	0	L83 and breast	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:08 PM
L84	10	L83 and (lactat$3 milk)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:08 PM
L85	14	L81 and (piezo piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:10 PM
L86	5	L75 and ((piezo piezoelectric) with air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:47 PM
L87	230	(((piezo piezoelectric) with air with pump$4) same (miniature small compact lightweight))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:48 PM
L88	6	L88 and (breast milk lactat$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 02:53 PM

L89	161	a61m$/$.cpc. and ((piezo piezoelectric piezo-electric) with air with pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:11 PM
L90	0	(2017/0072118).CCLS.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:19 PM
L91	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:19 PM
L92	40	(((piezo piezoelectric) with air with pump$4) same (miniature small compact lightweight)) same (vacuum$4 suction$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:22 PM
L93	3	"45513973".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/27 03:23 PM
L94	364	(((piezo piezoelectric) with pump$4) same (miniature small compact lightweight)) same (vacuum$4 suction$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:32 PM
L95	3	"20170035951"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:33 PM
L96	1	L96 and (suction$4 with piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/27 03:34 PM
L97	1	("20130064683").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:38 PM
L98	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/27 03:39 PM
L99	1	(US-20170172485-$).did.	(US-PGPUB)	OR	OFF	OFF	2018/08/28 04:48 PM
L100	0	L100 and "function of"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 04:48 PM
L101	100	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/28 05:19 PM

		US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-					

		7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L102	0	L102 and ((meaur$4 with milk) same rate)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:20 PM
L103	0	L102 and ((meaur$4 with milk) same (frequency speed))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:20 PM
L104	16	L102 and ((measur$4 with milk) same (frequency speed rate))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:21 PM
L105	0	L102 and ((measur$4 with milk) with "function of")	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 05:23 PM
L106	6	L102 and (decrease with (rate speed frequency strong))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:10 PM
L107	2	L102 and (latch$4 with adjust$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:22 PM
L108	50	(a61m$/$).cpc. and (wear$4 with pump$4) and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:24 PM
L109	0	(a61m$/$).cpc. and (wear$4 with pump$4) and (((center centre) with gravity) same comfort$5)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:25 PM
L110	83	(a61m$/$).cpc. and (((center centre) with gravity) same	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/28 06:26 PM

		comfort$5)					
L111	101	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 09:43 AM

		US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L112	3	L112 and (shield with (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:43 AM
L113	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:47 AM
L114	86	L114 and ((diapragm housing) with (housing case mount$4) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:53 AM
L115	9	L114 and ((diapragm membrane) with (housing case mount$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 09:54 AM

		with shield)					
L116	34	L112 and (diaphragm membrane)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:07 AM
L117	28	L114 and (diaphragm membrane) and (shield with dispos$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:10 AM
L118	28	L114 and ((diaphragm membrane) with (coupl$4 attach$4 mount$4) with shield)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:23 AM
L119	0	a61j16/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:41 AM
L120	409	a61j13/00.cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 10:42 AM
L121	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:23 PM
L122	23	L122 and (sens$4 same (orient$4 plac$4 situat$4) same (nipple shield))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:23 PM
L123	11	L122 and ((sens$4 accelerometer) with breast with (move moved moving movement))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:32 PM
L124	10	L122 and accelerometer	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 01:33 PM
L125	1	("20170072118").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 02:27 PM
L126	259	L122 and ((lower$4 decrea$4) with (suction$4 intens$4 pain comfort discomfort))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 02:51 PM
L127	45	L122 and ((lower$4 decrea$4) with (intens$4 pain comfort discomfort))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 02:59 PM
L128	11	(a61m$/$.cpc.) and ((miniature compact small) same (piezoelectric piezo-electric piezo) same pump$4 same (suction$4 vacuum$4) same (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 03:40 PM
L129	127	L122 and ((pressure	(US-PGPUB; USPAT;	OR	OFF	OFF	2018/08/29

		suction$4) with (mmhg kpa mbar pa bar))	USOCR; FPRS; EPO; JPO)				05:16 PM
L130	2	"60479361".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 05:29 PM
L131	106	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 05:31 PM

		20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L132	104	L132 and @ad<="20170615"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 05:32 PM
L133	14	(US-20160166745-$ or	(US-PGPUB; USPAT)	OR	OFF	OFF	2018/08/29

		US-20150283311-$ or US-20180110906-$ or US-20140378895-$ or US-20140031744-$ or US-20160220743-$ or US-20160256617-$ or US-20080177224-$ or US-20130023821-$ or US-20160058928-$ or US-20170043065-$ or US-20110004154-$).did. or (US-10039871-$ or US-6358226-$).did.					06:08 PM
L134	1	"52574056".FMID.	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2018/08/29 06:46 PM
L135	0	("2009024080").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 06:53 PM
L136	1	("20090024080").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2018/08/29 06:53 PM
L137	3390	(a61m1/062 a61m1/066 a61m1/06 a61m1/068 a61j/00).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 07:30 PM
L138	203	L138 and ((shield nipple) with (remov$4 replac$4 clean$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2018/08/29 07:30 PM
L139	1	("4535627").PN.	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/01/08 12:52 PM
L140	74	(("20180361040") or ("20180236147") or ("20120277728") or ("7785305") or ("20080208116") or ("7223255") or ("7789865") or ("8118772") or ("20080275385") or ("9956331") or ("8057425") or ("20070219486") or ("20020193731") or ("10046097") or ("20140378946") or ("20180326130") or ("20120316493") or ("8568350") or ("20030191427") or ("8070716") or ("9539377") or ("20160303298") or ("20160206794") or ("9539376") or ("20160310649") or ("20160287769") or ("20160310650") or ("20180001002") or	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/01/08 12:54 PM

		("20090099511") or ("7776008") or ("20090062731") or ("20160296682") or ("20050154349") or ("20030191433") or ("5749850") or ("20100292636") or ("7559915") or ("20080262420") or ("20160325031") or ("20170173232") or ("7749188") or ("6887217") or ("6139521") or ("20180021490") or ("20150065994") or ("20180028732") or ("20150196460") or ("9636282") or ("7758540") or ("8945046") or ("20080243059") or ("20110251552") or ("20170119942") or ("20130023821") or ("6997897") or ("9033913") or ("20150157776") or ("20090254028") or ("5514166") or ("20010038799") or ("20070161947") or ("20130046234") or ("8926556") or ("7255681") or ("7008400") or ("6257847") or ("20100145264") or ("20170151380") or ("20070078383") or ("5542921") or ("20180333523") or ("8075516") or ("20180369464") or ("20110071466")).PN.					
L141	111	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-2012004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2019/01/08 01:02 PM

		US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682- $).did. or (US- 20170072118-$ or US- 20170173232-$ or US- 20180008758-$ or US- 20180110906-$ or US- 20180126052-$ or US- 20160287481-$ or US- 20080039781-$ or US- 20110301533-$ or US- 20110314587-$ or US- 20130023821-$ or US- 20140142501-$ or US- 20140263611-$ or US- 20140378895-$ or US- 20160095967-$ or US- 20160183602-$ or US- 20180078687-$ or US- 20030027491-$ or US- 20030191433-$ or US- 20040024352-$ or US- 20060106334-$ or US- 20070161330-$ or US- 20080208116-$ or US- 20140052056-$ or US- 20160082166-$ or US- 20160220745-$ or US- 20160220743-$ or US- 20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or					

		US-20180333523-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L142	35	L142 and (heavy weight "center of gravity" "centre of gravity" mass)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:03 PM
L143	3497	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:22 PM
L144	284	L144 and (heavy weight "center of gravity" "centre of gravity")	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 01:22 PM
L145	3497	(a61m1/062 a61m1/066 a61m1/06).cpc.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/01/08 04:06 PM
L146	18	L146 and (weight with distribut$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2019/01/08 04:06 PM

			JPO)				
L147	1	("4535627").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/03/14 02:19 PM
L148	112	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2019/04/16 03:00 PM

		(US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					

L149	21	L149 and (pump$4 with (lightweight mass weight heavy))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 03:00 PM
L150	94	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (weight lightweight))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 03:14 PM
L151	47	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (mass heavy))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 05:04 PM
L152	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and (pump$4 with (mass heavy)) not L151	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/04/16 05:04 PM
L153	1	("20110274566").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/04/19 01:51 PM
L154	1	("20110274566").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/09 12:52 PM
L155	57	(breast with pump) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:04 AM
L156	1	(16/009547).APP.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/15 09:08 AM
L157	1	L157 and (pressure same noise)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:08 AM
L158	635	((piezo piezoelectric) with pump) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:10 AM
L159	1	L157 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:16 AM
L160	26	(breast with pump) and (mmhg and noise)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:24 AM
L161	1	L157 and (liter litre)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:30 AM
L162	1	((piezo piezoelectric) with pump) and "YIP Ventus"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:33 AM
L163	19	(("7550034") or ("8123502") or ("8297947") or ("8371829") or ("8409160") or ("8646479") or ("8734131") or ("8763633") or	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2019/08/15 09:36 AM

		("8821134") or ("9051931") or ("9127665") or ("9234518") or ("9239059") or ("9279421") or ("9334858") or ("9506463") or ("9752565") or ("9709042") or ("9777851")).PN.					
L164	5	L164 and (mmhg mbar kpa)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:36 AM
L165	0	L164 and (litre liter)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L166	2	L164 and piezo	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L167	17	L164 and (piezo piezoelectric)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:37 AM
L168	1	L164 and (piezo piezoelectric) and (noise same pressure)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2019/08/15 09:38 AM
L169	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:50 AM
L170	1	L170 and gravity	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:50 AM
L171	1	L170 and (gravity same nipple)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:51 AM
L172	61	(breast with pump$4) and ((centre center) with container)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:55 AM
L173	1	L170 and (gravity same container)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 10:55 AM
L174	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 11:54 AM
L175	1	L176 and (high height)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 11:54 AM
L176	25	(breast with pump$4) and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 12:55 PM
L177	113	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2020/01/09 03:02 PM

		US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or					

		US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$ or US-20180361040-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L178	30	L179 and noise	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/09 03:02 PM
L179	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	OFF	2020/01/13 01:45 PM

			JPO)				
L180	1	L181 and gravity	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:45 PM
L181	1	L181 and length	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:46 PM
L182	1	L181 and height	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/13 01:48 PM
L183	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:29 PM
L184	1	L185 and "half-way"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:29 PM
L185	113	(US-20020193731-$ or US-20040056641-$ or US-20150283311-$ or US-20160000980-$ or US-20160206794-$ or US-20180021490-$ or US-20120004603-$ or US-20170173233-$ or US-20080077042-$ or US-20010044593-$ or US-20030139702-$ or US-20050080376-$ or US-20060270973-$ or US-20070005006-$ or US-20070219486-$ or US-20080275386-$ or US-20090118573-$ or US-20100086419-$ or US-20130123689-$ or US-20140323962-$ or US-20140330200-$ or US-20140378946-$ or US-20150065994-$ or US-20160158424-$ or US-20160287768-$ or US-20160296682-$).did. or (US-20170072118-$ or US-20170173232-$ or US-20180008758-$ or US-20180110906-$ or US-20180126052-$ or US-20160287481-$ or US-20080039781-$ or US-20110301533-$ or US-20110314587-$ or US-20130023821-$ or US-20140142501-$ or US-20140263611-$ or US-20140378895-$ or US-	(US-PGPUB; USPAT; FPRS)	OR	OFF	OFF	2020/01/14 02:36 PM

		20160095967-$ or US-20160183602-$ or US-20180078687-$ or US-20030027491-$ or US-20030191433-$ or US-20040024352-$ or US-20060106334-$ or US-20070161330-$ or US-20080208116-$ or US-20140052056-$ or US-20160082166-$ or US-20160220745-$ or US-20160220743-$ or US-20170312409-$).did. or (US-20140180205-$ or US-20170368244-$ or US-20160228626-$ or US-20170172485-$ or US-20160166745-$ or US-20160058928-$ or US-20110004154-$ or US-20140031744-$ or US-20090206699-$ or US-20180228949-$ or US-20080177224-$ or US-20160135998-$ or US-20170043065-$ or US-20100292632-$ or US-20160256617-$ or US-20110071466-$ or US-20180333523-$ or US-20180361040-$).did. or (US-6440100-$ or US-6547756-$ or US-6749582-$ or US-8057425-$ or US-8118772-$ or US-8801495-$ or US-9033913-$ or US-8992445-$ or US-4024856-$ or US-5827191-$ or US-9192325-$ or US-6699213-$ or US-7662018-$ or US-5571084-$ or US-6227936-$ or US-8414353-$ or US-3840012-$ or US-4270538-$ or US-6358226-$ or US-10039871-$ or US-9155924-$ or US-7223255-$ or US-10046097-$ or US-5542921-$).did. or (WO-2015174330-$ or WO-2016024558-$ or					

		WO-2011012228-$ or EP-2502639-$ or CA-2955939-$ or CA-2955605-$ or WO-2016014488-$ or EP-3058967-$ or WO-2016156173-$ or WO-2016161050-$ or WO-2017139437-$ or WO-2017190024-$ or EP-2388026-$ or CA-2953333-$ or CN-203075300-$ or WO-2015085450-$ or WO-2013029407-$).did.					
L186	3	L187 and ((centre center) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:37 PM
L187	2	L187 and (top with heavy)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/14 02:37 PM
L188	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:06 AM
L189	1	L190 and (weight mass)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:06 AM
L190	1	L190 and (housing same battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:07 AM
L191	1	L190 and (shield same (mold$4 mould$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:08 AM
L192	1	L190 and (diaphragm same seal$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:09 AM
L193	0	L190 and (diaphragm same tunnel same flange)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L194	0	L190 and (diaphragm same spaced)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L195	0	L190 and (diaphragm same surround)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 11:15 AM
L196	1	verhoef.inv. and dog and figure	(US-PGPUB)	OR	OFF	OFF	2020/01/15 01:27 PM
L197	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:28 PM
L198	1	L199 and (shield with single)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:28 PM

L199	67	(a61m$/$).cpc. and (wear$4 with pump$4) and ((center centre) with gravity)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L200	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L201	1	L202 and (shield with single)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:32 PM
L202	1	L202 and (shield with piece)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 02:33 PM
L203	0	L202 and ((housing diagraphm) with spac$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:18 PM
L204	1	L202 and (shield with housing with diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:19 PM
L205	1	L202 and ((housing diaphragm) with spac$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/01/15 03:19 PM
L206	143	(breast with pump) and (piezo piezoelectric) and (membrane diaphragm)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 11:42 AM
L207	78	("20030191433" | "20040024351" | "20040101414" | "20050059928" | "20050131332" | "20050234370" | "20060106334" | "20080045888" | "20080177224" | "20080243059" | "20090024080" | "20100010682" | "20100106082" | "20100217148" | "20110071466" | "20110196291" | "20110245763" | "20110270162" | "20120101575" | "20120277728" | "20130023821" | "20130123688" | "20130131588" | "20130177455" | "20140066734" | "20140378895" | "20140378946" | "20150065994" | "20150100016" |	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2020/09/28 12:42 PM

		"20150148709" | "20150196247" | "20150292500" | "20160015876" | "20160256618" | "20160287769" | "20170072118" | "20170080134" | "20170173232" | "4263912" | "4311141" | "4768547" | "4821580" | "5542921" | "5634468" | "5658133" | "5810772" | "5827191" | "6273868" | "6287252" | "6328082" | "6440100" | "6547756" | "6579258" | "6712785" | "6840918" | "7201735" | "7223255" | "7621797" | "7824363" | "7972297" | "7988661" | "8057425" | "8070715" | "8070716" | "8262606" | "8282596" | "8353865" | "8357116" | "8376986" | "8671701" | "8684961" | "8801495" | "9050404" | "9162016" | "9173587" | "9199017" | "9278167" | "D459233").PN. OR ("10625005").URPN.					
L208	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 02:57 PM
L209	1	L210 and 19a	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 02:57 PM
L210	132289	"201" and recess	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:02 PM
L211	0	L210 and recess	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:02 PM
L212	645454	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:06 PM
L213	574	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. and diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/28 03:06 PM
L214	1	16/009547.app.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/29 09:51 AM
L215	1	L216 and flat	(US-PGPUB; USPAT;	OR	OFF	OFF	2020/09/29

			USOCR; FPRS; EPO; JPO)				09:51 AM
L216	57377	breast.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L217	398558	pump$4.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L218	92405	(piezo piezoelectric).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:16 PM
L219	72010	diaphragm.clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L220	26553	(db decibal).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L221	27368	(db decibal).clm.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L222	2	L218 and L219 and L220 and L221	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L223	2	L218 and L219 and L220 and L224	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2020/09/30 03:17 PM
L226	32	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((usb "universal serial bus") WITH (charg$4 recharg$4 power$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 12:16 PM
L227	0	214 AND (usb SAME socket)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:25 PM
L228	2	214 AND socket	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:25 PM
L229	2	"61007742".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; JPO)	OR	ON	ON	2021/05/18 12:34 PM

L230	7	"2015069095".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 12:38 PM
L231	122	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/18 01:00 PM

		20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-2018008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1					

		OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L232	18	231 AND recharg$5	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:00 PM
L233	2	214 AND (rigid SAME	(US-PGPUB; USPAT;	OR	ON	ON	2021/05/18

		shield)	USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				01:05 PM
L234	27173	a61m5/14244,14248.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:42 PM
L235	555	234 AND ((power$4 batter$4) WITH (charg$5 recharg$5) WITH (usb "universal serial bus"))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 01:42 PM
L236	82	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND bra AND wireless$4 AND (control$4 processor electronic$4) AND (power$4 battery)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 01:53 PM
L237	82	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND bra AND wireless$4 AND (control$4 processor electronic$4) AND (power$4 batter$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/18 01:53 PM
L238	14	231 AND ((charg$5 recharg$5) WITH (power$4 batter$4)) AND wireless$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 03:59 PM
L239	2	"20140275857".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 04:48 PM
L240	12	231 AND (rigid WITH (bottle container))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/05/18 04:52 PM

			AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L241	2	214 AND (shield WITH (flexible silicon$4 material soft rubber))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 05:35 PM
L242	2	231 AND (rigid WITH shield)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/18 05:38 PM
L243	128	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/20 03:05 PM

		US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-					

		A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-2016058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-					

		2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L244	8	243 AND ((membrane diaphragm) SAME shield)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/20 03:06 PM
L245	88	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH rigid)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:09 PM
L246	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH (plastic rigid) WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:13 PM
L247	7	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:13 PM
L248	68	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (rigid WITH polypropylene)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:14 PM
L249	25	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container) WITH steriliz$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:17 PM
L250	19	243 AND ((bottle container) WITH (rigid polypropylene plastic))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 03:23 PM
L251	21	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container) WITH magnet$6)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:49 PM
L252	2	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:57 PM

		((shield nipple flange) WITH guide WITH line)					
L253	207	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield nipple flange) WITH line)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 05:57 PM
L254	5	"6328709".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/20 05:59 PM
L255	91	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (nipple WITH line)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/20 06:00 PM
L256	130	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/21 12:39 PM

		20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1					

		OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-					

		2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L257	1	256 AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 12:39 PM
L258	6	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:40 PM
L259	6	(breast WITH pump$4) AND ((bottle container milk) WITH (clear transparent) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:41 PM
L260	73	(breast WITH pump$4) AND ((bottle container milk) WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:41 PM
L261	11	(breast WITH pump$4) AND ((bottle container milk bag) WITH (polycarbonate tritan)) AND ((bottle container milk storage bag) WITH (clear transparent "see through" see-through))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 12:45 PM
L262	55	(breast WITH pump$4) AND ((bottle container milk bag) WITH (magnet$6))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 01:09 PM
L263	182	(breast WITH pump$4) AND ((shield flange) WITH (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 01:26 PM
L264	132	((US-6440100-B1 OR US-6547756-B1 OR	(USPAT; US-PGPUB; FPRS; USOCR;	OR	ON	ON	2021/05/21 01:26 PM

		US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1	IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))				

		OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-					

		20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L265	9	264 AND (clear transparent) WITH (container bottle bag)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/05/21 01:27 PM

			IBM_TDB)				
L266	4	264 AND (polycarbonate) WITH (container bottle bag)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 01:27 PM
L267	6	(breast WITH pump$4) AND ((bottle container milk) WITH (polycarbonate tritan)) AND ((bottle container milk) WITH dishwash$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 02:28 PM
L268	34	264 AND ((alert$4 indicat$4 light) WITH (milk))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 03:46 PM
L269	19	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH start$4 WITH stop$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:36 PM
L270	21	264 AND (milk WITH (indicat$4 alert$4 display$4) WITH (flow$4 volume))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:39 PM
L271	20	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH threshold)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:55 PM
L272	95	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH (predetermin$4 limit level))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:58 PM
L273	38	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (milk WITH (quantity volume) WITH (predetermin$4 limit level) WITH (increas$4 decreas$4 chang$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 04:58 PM
L274	4	(a61m1/062 a61m1/066	(US-PGPUB; USPAT;	OR	OFF	OFF	2021/05/21

		a61m1/06 a41c4/04 a61j13/00).cpc. AND (pump$4 WITH alert$4 WITH (correct$4))	USOCR; FPRS; EPO; JPO)				05:00 PM
L275	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (operat$4 WITH alert$4 WITH (correct$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:00 PM
L276	9	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (alert$4 WITH (correct$4 proper$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:00 PM
L277	23	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH rotat$4 WITH position$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 05:44 PM
L278	62	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH slid$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:03 PM
L279	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH slid$4 WITH (attach$4 coupl$4 connect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:04 PM
L280	71	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) WITH thread$4 WITH (attach$4 coupl$4 connect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:06 PM
L281	26	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((clean$4 disinfect$4 sanitiz$4) WITH (shield flange) WITH (container bottle bag))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:20 PM
L282	111	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (diaphragm WITH (housing holder))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 06:44 PM
L283	2	"20120277728".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/05/21 06:46 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L284	7	264 AND (light WITH emit$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 06:55 PM
L285	11	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (db decibel)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:12 PM
L286	77	(breast WITH pump$4) AND (db decibel)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:17 PM
L287	75	willow AND (breast WITH pump$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/21 07:26 PM
L288	20047	(a61m a61b).cpcl. AND (pump$ wth piezo piezoelectric) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L289	9898	(a61m a61b).cpcl. AND (pump$ WITH piezo piezoelectric) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L290	892	(a61m a61b).cpcl. AND (pump$ WITH piezo piezoelectric) SAME (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L291	892	(a61m a61b).cpcl. AND (pump$4 WITH piezo piezoelectric) SAME (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:32 PM
L292	24	(a61m a61b).cpcl. AND (pump$4 WITH (piezo	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/05/21 07:33 PM

		piezoelectric)) SAME (decibel db)	AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L293	654	(a61m a61b).cpcl. AND (pump$4 WITH (piezo piezoelectric)) AND (decibel db)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/21 07:34 PM
L294	337	(a61m a61b).cpcl. AND (pump$4 WITH (piezo piezoelectric)) AND (decibel db)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/05/21 07:34 PM
L295	138	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/05/22 09:07 AM

		US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-					

		A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-					

		2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L296	13	295 AND (bar mbar kpa) AND "flow rate"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 09:07 AM
L297	2	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (pressure WITH kpa mmhg mbar bar) AND ((air vacuum$4 suction$4) WITH l/min)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/22 09:21 AM
L298	157	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (pressure WITH (kpa mmhg mbar bar))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/22 09:23 AM
L299	2	16/009547.app. AND (mechanism SAME container SAME housing)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L300	2	16/009547.app. AND (mechanism WITH container WITH housing)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/05/22 10:47 AM

			JPO; DERWENT; IBM_TDB)				
L301	40	295 AND magnet$6	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:50 AM
L302	6	295 AND (magnet$6 WITH (container bag bottle))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:51 AM
L303	599	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND diaphragm	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/24 12:04 PM
L304	7	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (shield WITH (polycarbonate tritan))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/05/24 02:33 PM
L305	140	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/02 03:38 PM

		OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-					

		20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1					

		OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1).did. AND FTDB.dbnm.)					
L306	2	140 AND piezo	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:38 PM
L307	14	140 AND piezo$8	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:38 PM
L308	32	305 AND piezo$8	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/06/02 03:39 PM

			JPO; DERWENT; IBM_TDB)				
L309	6	305 AND piezo$8 AND parallel	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 03:41 PM
L310	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((container milk bottle) WITH (angle tilt$4) WITH (sens$4 detect$4))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:47 PM
L311	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH right WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:54 PM
L312	78	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (which WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L313	14	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH data)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L314	10	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH sens$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:57 PM
L315	11	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND (left WITH breast WITH select$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 03:59 PM
L316	33	305 AND (maximum WITH (suction$4 vacuum$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/02 04:02 PM
L317	16	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((icon button) WITH start$4 WITH (stop$4	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:06 PM

		paus$4))					
L318	0	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH tritan)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:08 PM
L319	3	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH (transparent clear)) AND ((shield flange) WITH polycarbonate)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/02 04:08 PM
L321	195	((milk lactat$4 breast) WITH pump$4) AND ((shield flange) WITH magnet$6)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/14 01:25 PM
L322	4	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((shield flange) WITH (transparent clear)) AND ((shield flange) WITH (tritan polycarbonate))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/15 12:15 PM
L323	250	(a61m1/062 a61m1/066 a61m1/06 a41c4/04 a61j13/00).cpc. AND ((flange shield) SAME (diaphragm membrane))	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/06/15 01:51 PM
L324	19	("7550034," "8123502," "8297947," "8371829," "8409160," "8646479," "8734131," "8763633," "8821134," "9051931," "9127665," "9234518," "9239059," "9279421," "9334858," "9506463," "9752565," "9709042," "9777851").pn.	(USPAT)	OR	ON	ON	2021/06/16 12:28 PM
L325	9	324 AND stall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 12:28 PM
L326	19	"stall pressure" WITH (aspirat$4 vacuum$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2021/06/16 12:35 PM

		suction$4)	AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L327	4184	(stall WITH pressure WITH pump$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 12:39 PM
L328	3	324 AND mbar	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 01:42 PM
L329	50	(ttp WITH ventus)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 01:54 PM
L330	3	(ttp WITH ventus)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/06/16 01:54 PM
L331	252	(ventus)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/06/16 01:55 PM
L332	36	((stall WITH pressure WITH pump$4) SAME piezo$10)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 02:28 PM
L333	18	324 AND maximum	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 02:35 PM
L334	52	pump$4 WITH stall WITH piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/06/16 02:38 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L335	220	(breast SAME pump$4 SAME piezo$10)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 03:17 PM
L336	79	(breast WITH pump$4) AND (pressure WITH (stall$4 crack$4 occlusion break$4 block$4) WITH (mmhg kpa mbar bar pa))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 03:35 PM
L337	68	ventus AND piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:11 PM
L338	11	337 AND stall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:12 PM
L339	11	337 AND (mmhg mbar kpa)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/16 04:13 PM
L340	0	324 AND l/min	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:43 PM
L341	11	324 AND (air WITH flow$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	OR	ON	ON	2021/06/19 03:43 PM

			SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L342	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/19 03:48 PM

		A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR					

		US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR					

		WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L343	1	342 AND "l/min"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:49 PM
L344	6	324 AND (free WITH flow)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 03:49 PM
L345	2	("10881766").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 06:28 PM
L346	2	("10926011").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD,	OR	ON	ON	2021/06/19 06:44 PM

			DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L347	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/06/19 09:14 PM

		US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-					

		A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR					

		CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L348	39	347 AND piezo$10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:14 PM
L349	28	347 AND piezo$10 AND breast	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:14 PM
L350	2	"10881766".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/19 09:39 PM
L351	3	("9,585,998").pn.	(US-PGPUB; USPAT;	OR	ON	ON	2021/06/21

			USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				09:14 AM
L352	157	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-2007005006-A1 OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO))	OR	ON	ON	2021/07/14 04:33 PM

		A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-20180008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR					

		US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-					

		2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L353	8341	a61m1/06-066.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/13 09:11 AM
L354	147	353 AND ((shield flange) WITH rib)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/13 09:12 AM
L355	5	("5875976").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/10/13 11:12 AM

			IBM_TDB)				
L356	4	345 346	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/25 05:20 PM
L357	2	345 346	(USPAT)	OR	ON	ON	2021/10/25 05:20 PM
L358	158	((US-6440100-B1 OR US-6547756-B1 OR US-6749582-B2 OR US-8057425-B1 OR US-8118772-B2 OR US-8801495-B1 OR US-9033913-B2 OR US-8992445-B2 OR US-4024856-A OR US-5827191-A OR US-9192325-B2 OR US-6699213-B1 OR US-7662018-B1 OR US-5571084-A OR US-6227936-B1 OR US-8414353-B1 OR US-3840012-A OR US-4270538-A OR US-6358226-B1 OR US-10039871-B2 OR US-9155924-B1 OR US-7223255-B2 OR US-10046097-B2 OR US-5542921-A OR US-10625005-B2 OR US-8579874-B1 OR US-3702623-A).did. AND USPT.dbnm.) OR ((US-20020193731-A1 OR US-20040056641-A1 OR US-20150283311-A1 OR US-20160000980-A1 OR US-20160206794-A1 OR US-20180021490-A1 OR US-20120004603-A1 OR US-20170173233-A1 OR US-20080077042-A1 OR US-20010044593-A1 OR US-20030139702-A1 OR US-20050080376-A1 OR US-20060270973-A1 OR US-20070005006-A1	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN))	OR	ON	ON	2021/11/10 11:12 AM

		OR US-20070219486-A1 OR US-20080275386-A1 OR US-20090118573-A1 OR US-20100086419-A1 OR US-20130123689-A1 OR US-20140323962-A1 OR US-20140330200-A1 OR US-20140378946-A1 OR US-20150065994-A1 OR US-20160158424-A1 OR US-20160287768-A1 OR US-20160296682-A1 OR US-20170072118-A1 OR US-20170173232-A1 OR US-2018008758-A1 OR US-20180110906-A1 OR US-20180126052-A1 OR US-20160287481-A1 OR US-20080039781-A1 OR US-20110301533-A1 OR US-20110314587-A1 OR US-20130023821-A1 OR US-20140142501-A1 OR US-20140263611-A1 OR US-20140378895-A1 OR US-20160095967-A1 OR US-20160183602-A1 OR US-20180078687-A1 OR US-20030027491-A1 OR US-20030191433-A1 OR US-20040024352-A1 OR US-20060106334-A1 OR US-20070161330-A1 OR US-20080208116-A1 OR US-20140052056-A1 OR US-20160082166-A1 OR US-20160220745-A1 OR US-20160220743-A1 OR US-20170312409-A1 OR US-20140180205-A1 OR US-20170368244-A1 OR US-20160228626-A1 OR US-20170172485-A1 OR US-					

		20160166745-A1 OR US-20160058928-A1 OR US-20110004154-A1 OR US-20140031744-A1 OR US-20090206699-A1 OR US-20180228949-A1 OR US-20080177224-A1 OR US-20160135998-A1 OR US-20170043065-A1 OR US-20100292632-A1 OR US-20160256617-A1 OR US-20110071466-A1 OR US-20180333523-A1 OR US-20180361040-A1 OR US-20170035951-A1 OR US-20170143879-A1 OR US-20110004155-A1 OR US-20160288983-A1 OR US-20170274127-A1 OR US-20190209748-A1 OR US-20200397960-A1 OR US-20070219480-A1 OR US-20100145276-A1 OR US-20110009824-A1 OR US-20210060220-A1 OR US-20170112983-A1 OR US-20140275857-A1 OR US-20070179439-A1 OR US-20160228625-A1 OR US-20050154349-A1 OR US-20060025718-A1 OR US-20180028733-A1 OR US-20160325031-A1 OR US-20120277728-A1 OR US-20190143014-A1 OR US-20050247558-A1 OR US-20090281482-A1 OR US-20090281485-A1 OR US-20120277636-A1 OR US-20150141761-A1 OR US-20160331879-A1 OR US-20150328380-A1 OR US-20100324477-A1 OR US-20170226994-A1					

		OR US-20080243061-A1).did. AND PGPB.dbnm.) OR ((WO-2015174330-A1 OR WO-2016024558-A1 OR WO-2011012228-A1 OR EP-2502639-A1 OR CA-2955939-A1 OR CA-2955605-A1 OR WO-2016014488-A1 OR EP-3058967-A1 OR WO-2016156173-A1 OR WO-2016161050-A1 OR WO-2017139437-A1 OR WO-2017190024-A1 OR EP-2388026-A1 OR CA-2953333-A1 OR CN-203075300-U OR WO-2015085450-A1 OR WO-2013029407-A1 OR WO-2018062986-A1).did. AND FPRS.dbnm.) OR ((WO-2015069095-A1 OR CN-106794291-A OR WO-2020046777-A1 OR WO-2018202556-A1 OR CN-105873631-A OR WO-9622116-A1 OR CN-211835562-U OR KR-20170044650-A OR WO-2020217934-A1 OR JP-2016010524-A).did. AND FTDB.dbnm.) OR ((CN-211835562-U).did. AND DWPI.dbnm.)					
L359	0	L358 AND (shield WITH attach$4 WITH (rib detent protrusion))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/10 11:14 AM
L360	0	358 AND (shield WITH attach$4 WITH (detent rib protrusion))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/10 11:12 AM
L361	24	(breast WITH pump$4)	(US-PGPUB; USPAT;	OR	ON	ON	2021/11/10

		AND (shield WITH attach$4 WITH (rib detent protrusion))	USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:15 AM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	64788	breast.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:26 PM
N2	429460	pump$4.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:26 PM
N3	1065320	housing.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:26 PM
N4	0	shield.clm	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:26 PM
N5	134217	shield.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:26 PM
N6	77409	diaphragm.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:26 PM
N7	485118	recess.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:27 PM
N8	4238372	surface.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:27 PM
N9	13	N1 AND N2 AND N3 AND N5 AND N6 AND N7 AND N8	(US-PGPUB; USPAT)	OR	ON	ON	2022/02/10 04:27 PM

Docket No.: ELVI-002/07US 339454-2026
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Jonathan O'TOOLE	Confirmation No.:	9649
Application No.:	17/203,050	Group Art Unit:	3783
Filed:	March 16, 2021	Examiner:	FREDRICKSON, COURTNEY B

For: BREAST PUMP SYSTEM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT/RESPONSE TO FINAL OFFICE ACTION

In response to the final Office Action dated November 4, 2021, to which the deadline for responding is February 4, 2022, Applicant submits the following Amendments and/or Remarks, and respectfully requests reconsideration of the application in view thereof.

Any extensions of time necessary to prevent abandonment of this application are hereby petitioned for under 37 C.F.R. §1.136(a), and any additional fees required (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 50-1283.

Amendments to the Claims are reflected in the listing of the claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: Jonathan O'TOOLE	Confirmation No.: 9649
Applicant: Chiaro Technology Limited	Art Unit: 3783
Application No.: 17/203,050	Examiner: FREDRICKSON, Courtney B.
Filing Date: March 16, 2021	Atty. Docket: 4944.0120007

Title: **BREAST PUMP SYSTEM**

Amendment Under 37 C.F.R. § 1.312

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Mail Stop Issue Fee

Commissioner:

Submitted herein is an Amendment Under 37 C.F.R. § 1.312. As payment of the issue fee has not yet been made or is filed herewith, Applicant respectfully submits that filing under 37 C.F.R. § 1.312 is proper. (M.P.E.P. § 714.16.)

If extensions of time are necessary to prevent abandonment of this application, then they are petitioned for under 37 C.F.R. § 1.136(a). Any additional fees required to continue prosecution or appeal of this application (including issue fee, fees for net addition of claims or forwarding to appeal) are hereby authorized to be charged to our Deposit Account No. 19-0036.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently amended) A breast pump device that is configured as a self-contained, in-bra wearable device, the breast pump device comprising:

~~(i)~~ a housing that includes:

~~(a)~~ a battery, and

~~(b)~~ a pump powered by the battery and generating negative air pressure;

~~(ii)~~ a breast shield made up of a breast flange and a nipple tunnel;

~~(iii)~~ a milk container that is configured to be attached to and removed from the housing; and

~~(iv)~~ a diaphragm configured to be seated against a diaphragm holder that forms a recess or cavity at least in part with an external surface of the housing, the diaphragm deforming in response to changes in air pressure caused by the pump to create negative air pressure in the nipple tunnel.

2. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the pump comprises a piezo air pump system.

3. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the pump is positioned at or close to a base of the housing.

4. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ a total mass of the breast pump device, unfilled with milk, is less than 250 gm.

5. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast pump device makes less than 30 dB noise at maximum power and less than 25 dB at normal power, against a 20 dB ambient noise.

6. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast shield is substantially rigid.

7. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto a breast.

8. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast shield is a one piece item that, in use, presents a single continuous surface to a nipple and a breast.

9. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast shield integrates the breast flange and nipple tunnel as a one-piece item.

10. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast flange and the nipple tunnel are a single, integral item with no joining stubs.

11. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast shield is generally symmetrical about a centre-line running from a top to a bottom of the breast shield when positioned upright for normal use.

12. (Canceled)

13. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.

14. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the breast pump device includes only the breast shield and the milk container that are directly removable from the housing in normal use or normal dis-assembly.

15. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the diaphragm is a flexible membrane.

16. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the diaphragm is substantially circular and is configured to self-seal under the negative air pressure to a substantially circular diaphragm holder that is part of the housing.

17.–18. (Canceled)

19. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container is substantially rigid.

20. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container is configured to attach to a lower part of the housing and to form a flat bottomed base for the breast pump device.

21. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container has a surface shaped to continue a curved shape of the housing, so that the breast pump device can be held comfortably inside the bra.

22. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container includes a flexible valve that self-seals under negative air pressure against a milk opening in the nipple tunnel and that permits milk to flow into the milk container.

23. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container is attachable to the housing with a mechanical or magnetic mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.

24. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container includes a cap that is removable from the milk container and a removable valve that enables milk to pass into the milk container in one direction.

25. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ a top of the milk container includes an optically clear region that is aligned below one or more light emitters positioned in a base of the housing.

26. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the milk container is wider than the milk container is tall.

27. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the housing includes a wireless data communications system powered by the battery.

28. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the housing has a front surface that is configured to fit inside a bra and to contact an inner surface of the bra, and a rear surface that is shaped to contact, at least in part, the breast shield.

29. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the housing includes at least one of a visual or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.

30. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein ~~in which~~ the housing includes at least one of a visual or haptic indicator that indicates if the pump is operating correctly to pump milk, based on whether a quantity or a height of liquid in the milk container above a base of the milk container is increasing above a threshold rate of increase.

31. (Canceled)

32. (Currently amended) The breast pump device of claim ~~Claim~~ 1, wherein the battery is a rechargeable battery, and the housing further includes:

~~(c)~~ a power charging circuit for controlling the charging of the rechargeable battery, and

~~(d)~~ control electronics powered by the rechargeable battery.

Remarks

Claims 1–11, 13–16, 19–30, and 32 are amended. This change does not introduce any new matter. The amendment corrects formal matters without changing the scope of the claims. Accordingly, Applicant respectfully requests that this amendment be entered.

Reconsideration of this application and entry of the above amendment is respectfully requested.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Anupma Sahay #78,704/

Anupma Sahay
Attorney for Applicant
Registration No. 78,704

Date: May 3, 2022

1100 New York Avenue, N.W.
Washington, D.C. 20005-3934
(202) 371-2600

18257897.1

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/203,050	05/03/2022 05:40:29 PM ET	4944.0120007

Title of Invention

BREAST PUMP SYSTEM

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	9649	FILED BY	Kim Perry
PATENT CENTER #	60651120	AUTHORIZED BY	Anupma Sahay
CUSTOMER #	26111	FILING DATE	03/16/2021
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Jonathan O'TOOLE

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 3007	E202253H41554067	Kim Perry

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2501	UTILITY ISSUE FEE	600.00	1	600.00
			TOTAL AMOUNT:	$600.00

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage

submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/203,050	**05/03/2022 05:40:29 PM ET**	**4944.0120007**

Title of Invention

BREAST PUMP SYSTEM

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	9649	FILED BY	Kim Perry
PATENT CENTER #	60651120	FILING DATE	03/16/2021
CUSTOMER #	26111	FIRST NAMED INVENTOR	Jonathan O'TOOLE
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Anupma Sahay

Documents

TOTAL DOCUMENTS: 5

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
2022-05-03-Amendment-1_312-4944-0120007.pdf		6	-	111 KB
2022-05-03-Amendment-1_312-4944-0120007-A.NA.pdf	(1-1)	1	Amendment after Notice of Allowance (Rule 312)	98 KB
2022-05-03-Amendment-1_312-4944-0120007-CLM.pdf	(2-5)	4	Claims	78 KB
2022-05-03-Amendment-1_312-4944-0120007-REM.pdf	(6-6)	1	Applicant Arguments/Remarks Made in an Amendment	71 KB

2022-05-03-Issue-Fee-4944-0120007.PDF	1	Issue Fee Payment (PTO-85B)	261 KB

Warning: The attached file contains comments or annotations. Comments are not recommended and may cause processing problems with the document.

2022-05-03-Transmittal-Form-4944-0120007.PDF	2	Transmittal Letter	265 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2022-05-03-Amendment-1_312-4944-0120007.pdf	3C100F6448BD72521CB4CCD4E5053904C251F988B2DD84DF5C969D205D9F407A6E77E07F636D8F316A2FC74B84767E3CA81ACF50B0CE765B581CFF8F4B38D880
2022-05-03-Amendment-1_312-4944-0120007-A.NA.pdf	883CB33B9B0E762B46399A293C3CA16EFA8A4BB90A4CBE0C3EC0C36F7AFF10ABCD77231551C13D23C0CB9138DEAF0AA060A18309658C9B3224F6B0793AC57D62
2022-05-03-Amendment-1_312-4944-0120007-CLM.pdf	B2E09108505F41ECE0C143ED5F1211500CB956ADE82A9D5B8301235F9C27E74B779840B9C9FD60EEA8471DDF6E22426171242DADD23A84CAF48EF3E9D8F825AE
2022-05-03-Amendment-1_312-4944-0120007-REM.pdf	C1E096C09CBA35D0C6EC24808D50855B39C6B5EDEDA707109682CA0CAB167E1A019BB4141E1F8E887CC7E9C6C882B8BCF7CCA3FA9496907BA7E4DB375D7DB405
2022-05-03-Issue-Fee-4944-0120007.PDF	C29C1503B96514B2FE2EBA2BA21FB641AEEC16505CF408C7F6E8CFD42618865876E680A55B8882B156D0CEAA485495A2149FBE98008E2BE32D3BEF2479E59683
2022-05-03-Transmittal-Form-4944-0120007.PDF	4A9EC5C26D953CAC106FF309A14322A96469316DAA273F39155AE2CAA6E225107661EE604A0A50C67DCEC33A1465281672C1CDFD977B9C1C66BB046D85AA1633

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized

by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26111 7590 02/23/2022
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	ELVI-002/07US	9649

TITLE OF INVENTION: BREAST PUMP SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	05/23/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
FREDRICKSON, COURTNEY B	3783	604-067000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Sterne, Kessler, Goldstein & Fox

2 P.L.L.C.

3 ______

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Chiaro Technology Limited

(B) RESIDENCE: (CITY and STATE OR COUNTRY): London, United Kingdom

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies ______

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 19-0036

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Anupma Sahay #78,704/ Date May 3, 2022

Typed or printed name Anupma Sahay Registration No. 78,704

Doc Code: TRAN.LET
Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 12/31/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	17/203,050
Filing Date	03/16/2021
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	FREDRICKSON, Courtney B.
Attorney Docket Number	4944.0120007
Total Number of Pages in This Submission	

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [x] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please Identify below):

Remarks

Online Credit Card Authorization for $600.00 to cover:

$600.00 - Issue Fee

The Office may charge any fee deficiency for any submission made with this transmittal to Deposit Account 19-0036.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Sterne, Kessler, Goldstein & Fox P.L.L.C.		
Signature	/Anupma Sahay #78,704/		
Printed name	Anupma Sahay		
Date	May 3, 2022	Reg. No.	78,704

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name		Date	

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	03/16/2021	Jonathan O'TOOLE	4944.0120007	9649

26111 7590 05/18/2022
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
FREDRICKSON, COURTNEY B	

ART UNIT	PAPER NUMBER
3783	

NOTIFICATION DATE	DELIVERY MODE
05/18/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

e-office@sternekessler.com

Response to Rule 312 Communication	**Application No.** 17/203,050	**Applicant(s)** O'TOOLE et al.	
	Examiner COURTNEY FREDRICKSON	**Art Unit** 3783	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☑ The amendment filed on 03 May 2022 under 37 CFR 1.312 has been considered, and has been:

a) ☐ entered.

b) ☑ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

f) ☐ not entered because the supplemental or corrected Application Data sheet (ADS)

☐ was not accompanied by a petition to accept an unintentionally delayed claim under 37 CFR 1.55 or 27 CFR 1.78;

☐ did not identify the information being changed in accordance with 37 CFR 1.76(c)(2);

☐ was not properly signed in accordance with 37 CFR 1.76(e) (or 37 CFR 1.33(b) for applications filed prior to September 16, 2012).

/COURTNEY B FREDRICKSON/ Examiner, Art Unit 3783	/NATHAN R PRICE/ Supervisory Patent Examiner, Art Unit 3783

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: Jonathan O'TOOLE

Applicant: Chiaro Technology Limited

Application No.: 17/203,050

Filing Date: March 16, 2021

Title: **BREAST PUMP SYSTEM**

Confirmation No.: 9649

Art Unit: 3783

Examiner: FREDRICKSON, Courtney B.

Atty. Docket: 4944.0120007

Amendment Under 37 C.F.R. § 1.312

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Mail Stop Issue Fee

Commissioner:

Submitted herein is an Amendment Under 37 C.F.R. § 1.312. As payment of the issue fee has not yet been made or is filed herewith, Applicant respectfully submits that filing under 37 C.F.R. § 1.312 is proper. (M.P.E.P. § 714.16.)

If extensions of time are necessary to prevent abandonment of this application, then they are petitioned for under 37 C.F.R. § 1.136(a). Any additional fees required to continue prosecution or appeal of this application (including issue fee, fees for net addition of claims or forwarding to appeal) are hereby authorized to be charged to our Deposit Account No. 19-0036.

Doc Code: TRAN.LET
Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	17/203,050
Filing Date	03/16/2021
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	FREDRICKSON, COURTNEY B
Attorney Docket Number	4944.0120007
Total Number of Pages in This Submission	

ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Marked Up Application Data Sheet

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Sterne, Kessler, Goldstein & Fox P.L.L.C.		
Signature	/Anupma Sahay #78,704/		
Printed name	Anupma Sahay		
Date	May 23, 2022	Reg. No.	78,704

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name		Date	

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/203,050	**05/23/2022 05:10:40 PM ET**	**4944.0120007**

Title of Invention

BREAST PUMP SYSTEM

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	9649	FILED BY	Tierra Brown
PATENT CENTER #	60682528	FILING DATE	03/16/2021
CUSTOMER #	26111	FIRST NAMED INVENTOR	Jonathan O'TOOLE
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Anupma Sahay

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2022-05-23-ADS-Transmittal-4944-0120007.PDF	2	Transmittal Letter	230 KB
2022-05-23-Marked-Up-ADS-4944-0120007.PDF	2	Application Data Sheet	112 KB

Warning: This is not a USPTO supplied ADS fillable form. Data in the form cannot be automatically loaded to other USPTO systems.

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)

2022-05-23-ADS-Transmittal-4944-0120007.PDF	03AB2F7610196F1E4451C417FA5AE596D91C54686B69D061341FE1F4C94E48D1584DD1651082CB7911184BBDE609D6CF4A01811B956C77D58AF13B529D4CF07D
2022-05-23-Marked-Up-ADS-4944-0120007.PDF	884855E7F6162E8E83F8F37FAF389D56934AD19BD9CF5BCD9C1B784440FD7580B2BC9B588E6AC839D21795DBC227DFDA83B565667B2CDF882FC788A54C199978

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO AIA/14 Equivalent (01-22)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4944.0120007
	Application Number	17/203,050
Title of Invention	BREAST PUMP SYSTEM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Legal Name

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Jonathan		O'TOOLE	

Residence Information (Select One):
☐ US Residency ☒ Non US Residency ☐ Active US Military Service

City	~~London~~ Bristol	**State/Province**		**Country of Residence**	GB

Mailing Address of Inventor:

Address 1	c/o Chiaro Technology Limited		
Address 2	63-66 Hatton Garden		
City	London	**State/Province**	
Postal Code	EC1N 8LE	**Country**	GB

Inventor 2 Legal Name

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Adam		ROLLO	

Residence Information (Select One):
☐ US Residency ☒ Non US Residency ☐ Active US Military Service

City	London	**State/Province**		**Country of Residence**	GB

Mailing Address of Inventor:

Address 1	c/o Chiaro Technology Limited		
Address 2	63-66 Hatton Garden		
City	London	**State/Province**	
Postal Code	EC1N 8LE	**Country**	GB

PTO AIA/14 Equivalent (01-22)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	4944.0120007
	Application Number	17/203,050
Title of Invention	BREAST PUMP SYSTEM	

Inventor 3 Legal Name							
Prefix	**Given Name**		**Middle Name**		**Family Name**		**Suffix**
	Andrew				CARR		
Residence Information (Select One):							
☐ US Residency		☒ Non US Residency		☐ Active US Military Service			
City	~~London~~ Edinburgh	**State/Province**			**Country of Residence**	GB	
Mailing Address of Inventor:							
Address 1	c/o Chiaro Technology Limited						
Address 2	63-66 Hatton Garden						
City	London		**State/Province**				
Postal Code	EC1N 8LE		**Country**	GB			

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Anupma Sahay #78,704/			**Date (YYYY-MM-DD)**	2022-05-23
First Name	Anupma	**Last Name**	Sahay	**Registration Number**	78,704

18490181.1

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/203,050	06/14/2022	11357893	4944.0120007	9649

26111 7590 05/25/2022

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Jonathan O'TOOLE, London, UNITED KINGDOM;
Adam ROLLO, London, UNITED KINGDOM;
Andrew CARR, London, UNITED KINGDOM;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

CHIARO TECHNOLOGY LIMITED, London, UNITED KINGDOM;

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

U.S. Patent No.: 11,357,893	Confirmation No.: 9649
Date of Patent: June 14, 2022	Art Unit: 3783
First Named Inventor: Jonathan O'TOOLE	Atty. Docket: 4944.0120007
Patentee: Chiaro Technology Limited	
Title: **BREAST PUMP SYSTEM**	

Request for Certificate of Correction Under 37 C.F.R. § 1.322

Attn: Certificate of Correction Branch

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Commissioner:

It is hereby requested that a Certificate of Correction under 37 C.F.R. § 1.322 be issued for the above-captioned United States Patent. This Certificate of Correction is being requested due to mistakes which appear in the printed patent. These mistakes were made by the U.S. Patent and Trademark Office.

Specifically, the printed patent contains the following errors for which a Certificate of Correction is respectfully requested:

On Face Page, Col. 1, Field (72), in “Inventors”, Line 1, delete “London” and insert - - Bristol - -, therefor.

On Face Page, Col. 1, Field (72), in “Inventors”, Line 3, delete “London” and insert - - Edinburgh - -, therefor.

Remarks

The above-noted corrections do not involve such changes in the patent as would constitute new matter or would require reexamination.

A completed Form PTO/SB/44 accompanies this request, with the above-noted corrections printed thereon. Accordingly, a Certificate of Correction is believed proper and issuance thereof is respectfully requested.

The Commissioner is hereby authorized to charge any fee deficiency, or credit any overpayment, to our Deposit Account No. 19-0036.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

/Anupma Sahay #78,704/

Anupma Sahay
Attorney for Patentee
Registration No. 78,704

Date: July 19, 2022

1100 New York Avenue, N.W.
Washington, D.C. 20005-3934
(202) 371-2600

18701068.1

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 11,357,893 B2

APPLICATION NO. : 17/203,050

ISSUE DATE : June 14, 2022

INVENTOR(S) : O'Toole, et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On Face Page, Col. 1, Field (72), in "Inventors", Line 1, delete "London" and insert - - Bristol - -, therefor.

On Face Page, Col. 1, Field (72), in "Inventors", Line 3, delete "London" and insert - - Edinburgh - -, therefor.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Sterne, Kessler, Goldstein & Fox P.L.L.C. 1100 New York Avenue, N.W.
Washington, DC, 20005

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	46220205
Application Number:	17203050
International Application Number:	
Confirmation Number:	9649
Title of Invention:	BREAST PUMP SYSTEM
First Named Inventor/Applicant Name:	Jonathan O'TOOLE
Customer Number:	26111
Filer:	Anupma Sahay/Rolonda Lee
Filer Authorized By:	Anupma Sahay
Attorney Docket Number:	4944.0120007
Receipt Date:	19-JUL-2022
Filing Date:	16-MAR-2021
Time Stamp:	13:52:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	2022-07-19-Transmittal-Form-4944-0120007.PDF	211044 1b53c9274f06832452ac33b5f7b9e3dd1737c409	no	1

Warnings:

Information:

2	Request for Certificate of Correction	2022-07-19-Request-COC-4944-0120007.pdf	102935 ba6ce43f8d0511a5e7e062e8a2ed0baf204548f8	no	2
Warnings:					
Information:					
3	Request for Certificate of Correction	2022-07-19-PTOSB44-4944-0120007.pdf	138264 5a74d498f2352a9fe62db8838a6e17e3e650b12f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	452243		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRAN.LET
Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 12/31/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	17/203,050
Filing Date	03/16/2021
First Named Inventor	Jonathan O'TOOLE
Art Unit	3783
Examiner Name	FREDRICKSON, Courtney B.
Attorney Docket Number	4944.0120007
Total Number of Pages in This Submission	

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) ________
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☑ Other Enclosure(s) (please Identify below):

Request for Certificate of Correction Under 37 C.F.R. § 1.322; PTO/SB/44 Form

Remarks

The Office may charge any fee deficiency for any submission made with this transmittal to Deposit Account 19-0036.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Sterne, Kessler, Goldstein & Fox P.L.L.C.		
Signature	/Anupma Sahay #78,704/		
Printed name	Anupma Sahay		
Date	July 19, 2022	Reg. No.	78,704

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name		Date	

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 11,357,893 B2
APPLICATION NO. : 17/203050
DATED : June 14, 2022
INVENTOR(S) : O'Toole et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

Column 1, Item (72), in "Inventors", Line 1, delete "London" and insert -- Bristol --, therefor.

Column 1, Item (72), in "Inventors", Line 3, delete "London" and insert -- Edinburgh --, therefor.

Signed and Sealed this
Sixteenth Day of August, 2022

Katherine Kelly Vidal

Katherine Kelly Vidal
Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

ACKNOWLEDGEMENT OF LOSS OF ENTITLEMENT TO ENTITY STATUS DISCOUNT

APPLICATION #	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET #	REQUEST ID
17/203,050	03/16/2021	Jonathan O'TOOLE	4944.0120007	184269

The entity status change request below filed through Patent Center on 03/19/2024 has been accepted.

Certifications

APPLICANT CHANGING TO REGULAR UNDISCOUNTED FEE STATUS

Signature

I certify, in accordance with 37 CFR 1.4(d)(4), that I am one of the signatories making the entity status change.

Signature	Name	Registration #
/Yangbeini Wang #800,005/	Yangbeini Wang	800005